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Letters

The Eternal Gap Between Ideals and Behavior

The inconsistencies between attitudes and behavior illuminated by the Braithwaite survey (*Int J Stud Anim Prob* 3(1):42, 1982) are not confined to the general public; they are also rife within the animal welfare movement.

Thus, we see that otherwise credible humane societies are in the persistent habit of serving up their own "welfare" meetings the products of that very cruelty which they campaign against. Is it surprising that they fail to influence the public as much as they would wish?

I would submit that the discrepancy between attitude and behavior may not simply be the result of failing to live up to one's own ideals. The alternative explanation for the behavior could be that those displaying it have been less than truthful about their attitudes. Every day human society demonstrates in numerous ways that it does not really care that much about animal suffering.

It is, after all, much easier to fill in a questionnaire than to alter one's habits.

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Discrepancy Between Successful Adaptation and Welfare

I was delighted to read Professor Beilharz's penetrating discussion of animal welfare in the *Journal* (*Int J Stud Anim Prob* 3(2):117, 1982). One point of disagreement I would like to raise concerns Beilharz's assumption about the welfare of animals in their species-typical environments. On p. 122 of his paper he says that "we can do no better than *to assume that the welfare of any adapted form of life is guaranteed, i.e.,* that it does not suffer in its particular environment" (his italics).

My particular doubts about this statement concern two aspects of genetic adaptation. The first of these is that animals are not ideally adapted to every aspect of their environments. Rather, animals are "complicated sets of compromises" (Morris, 1964) to all prevailing environmental pressures. For example, the injury (often serious) sustained during competition between conspecifics is a compromise resulting from the demand for resources exceeding supply (Geist, 1971; Wilkinson and Shank, 1976; Southwick, 1970). Also, the trauma of weaning in mammals is the compromise solution to parent-offspring conflict (Trivers, 1974). These are instances of considerable suffering occurring in well-adapted animals. The compromise nature of genetic adaptations, along with the inevitable variation between individual animals around the species norm suggests that, at most, only a few members of a few species will be sufficiently well adapted to have their welfare guaranteed.

It might be thought that this does not jeopardize the principle that Beilharz was trying to convey but merely requires it to be qualified. It could thus be suggested that "within the limits imposed by conflicting environmental pressures, welfare, in a species-typical environment, will be optimized by genetic adaptation." This brings me to the second aspect of genetic adaptation about which I have doubts.

A great contribution by Lehrman (1970) to the nature-nurture controversy was to point out that "nature selects for outcomes." By this he meant that natural selection operates on the consequences

of genetically adapted processes rather than on the actual processes themselves. For example, the experience of hunger evolved to regulate the intake of food. So long as an adequate intake of food is achieved without interfering with other biological processes, the nature of the feelings of hunger experienced by the animal will be irrelevant to natural selection. All psychological traits that increase an animal's reproductive fitness will be selected for *even if they cause discomfort and distress in the process.* It is the effects of psychological traits on reproductive fitness which are subject to genetic adaptation rather than their effects on welfare. All of animals' hedonic experiences will be the means of bringing about sexual, exploratory, feeding or other behaviors. Natural selection will genetically adapt animals according to the outcome of these behaviors, rather than the means by which they were brought about. In other words, what the animal experiences is generally unimportant for the purposes of genetic adaptation, provided that it induces the animal to interact appropriately with its environment.

From Beilharz's original suggestion — that we can do no better than to assume that the welfare of any adapted form of life is guaranteed — I have argued that: (1) all the characteristics of individual animals are compromises and not ideal adaptations to the environment; and (2) the welfare effects of psychological traits will not be genetically adapted, provided the animal is induced to interact appropriately with its environment.

The welfare of any genetically adapted animal could therefore be unsatisfactory in the environment to which it is adapted.

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Dr. Beilharz Responds

I largely concur with Dr. Baxter's views, but wish to make the following additional comments.

1. I agree that when populations of animals adapt to their environment, compromises will be made among the different demands that the environment imposes. This must be particularly true in the variable and unpredictable environments of many wild animals and of domestic animals kept extensively.

One can go further, however, to say that if, in nature, animals continue to be subject to conflicting environmental pressures that genetic adaptation of animals cannot adequately meet, then it is unreasonable for anyone to demand, as many do, that a more complete matching of the environment to the needs of animals should be achieved for farm animals. Even in farm animals kept intensively, genetic adaptation is occurring, unless we prevent it, and in due course, even in this "new" environment, welfare "will be optimized by genetic adaptation."

2. I agree with Dr. Baxter's second point that "nature selects for outcomes." Yes, it is those genes that are passed on, which were carried by the individuals that achieved an adequate food intake resulting in survival and reproduction, regardless of how this came about. However, I believe that if an animal obtains adequate feed only after significant pain or hunger (in other words after some depression of its welfare), while another animal in the same environment does so with less discomfort, there will usually be some real side-effects accompanying the depression in welfare, so that in the long run selection will favor the genotypes whose welfare is not depressed. This leads me to repeat the point in my paper. I believe that the desert mammal no longer suffers from thirst (*i.e.*, plagued by a feeling accompanying thirst) in the same way as would a human who had had nothing to drink for 3 days. Thus, I do believe that genetic adaptation will, in general, also take care of the welfare aspects of psychological traits. However, I realize that this is a question that is very difficult to resolve experimentally.

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Pigeon experts know that pigeons cannot be exterminated. At most they can be moved about. The greatest American practitioner of the science of moving pigeons about was one Lewis Neid, of St. Paul, Minnesota. The Neid technique might not work in Washington, but it was perfect for St. Paul. At the height of Neid's career, St. Paul had only three tall buildings: the State Capitol on a hill to the north, the Arch-Diocesan Cathedral on a hill to the northwest, and the first National Bank building, on what was called the upper levee. Neid hired himself out as pigeon remover to church, state, and commerce, but never to all three simultaneously. In this way, the pigeons always had a safe haven in at least one of the three buildings, while each of the three great estates of St. Paul could feel that they were rid of pigeons most of the time.

Eugene McCarthy

Eugene McCarthy is the former senator from Minnesota. This article was reprinted from **The New Republic**, February 14, 1981.

John Steinbeck told a little story—a personal story as wine-dry as the hills of Baja California where it is laid. With a companion, he was resting in the shade while a couple of Indian friends scoured the hills for borrego, or bighorn sheep. He wrote that this is "the nicest hunting we have ever had....We do not like to kill things—we do it when it is necessary but we take no pleasure in it." Toward evening, the Indians return without sheep but with solid evidence thereof. "On the way back from the mountain, one of the Indians offered us his pocketful of sheep droppings, and we accepted only a few because he did not have many and he probably had relatives who wanted them....For ourselves, we have had mounted on a small hardwood plaque one perfect borrego dropping. And where another man can say, 'There was an animal, but because I am greater than he, he is dead and I am alive, and there is his head to prove it,' we can say, 'There was an animal, and for all we know there still is and here is the proof of it. He was very healthy when we last heard of him.'"

This article is reprinted from John Steinbeck and Edward F. Ricketts, **Sea of Cortez: A Leisurely Journal of Travel and Research** (New York: Viking, 1941), pp. 163-167.

Editorials

Reader Survey

Andrew N. Rowan

As many of our American readers know, we recently polled 600 subscribers to find out what they think of the *Journal* to date and how they feel we should develop in the future. We received an excellent response — 26% (156) returned completed questionnaires and data from these are presented in Tables 1 and 2.

In general, we believe that these results indicate that the *Journal* is moving in the right direction. However, eight respondents gave the *Journal* a "poor" rating, and there was definitely less enthusiasm among scientists than among animal welfare advocates. Of those who graded the *Journal* as being poor, the major criticism was one of bias. Thus, one respondent noted "While the *Journal* may try to present a spectrum of opinions, I feel that it does not. The *Journal* appears to be essentially an organ for pro-animal welfare views." It is certainly true that the bulk of our *published* articles favor animal welfare, but this is merely a reflection of the fact that most of the articles submitted for publication tend to be written from an animal welfare perspective. When we have had articles that do not fit this mold (e.g., Lindsey, *IJSAP* 1:229-233; Turner and Strak, *IJSAP* 2:15-18; and Hutchins *et al.* in this issue), we have usually had to solicit them ourselves.

Perhaps it was unrealistic of us to hope to receive articles arguing opposite points of view, given our sponsorship and the known interests of the editors. However, we are disappointed that some individuals who hold different views have reportedly decided not to submit articles to the *Journal* because "they do not want to give us any legitimacy." Under such circumstances, we feel that the admittedly biased context of the *Journal* is more the result of a lack of trust and dialogue in the past, than of any hidden agenda on our part. We hope that those of our readers who would like to see more debate will either contribute their own thoughts or else encourage their colleagues to submit articles.

One interesting suggestion was that we should follow the example of *The Behavioral and Brain Sciences*. This is a periodical, recently brought to my attention, in which a paper is distributed to a range of respected academics in the field who then comment on it. The author is given a chance for a final rebuttal. We may be able to adapt this idea to our *Journal,* although we will probably have to publish the original article and comments in successive issues because of space constraints.

We were also intrigued by the comments of several that there was too much of a vegetarian slant in the *Journal.* There have undoubtedly been occasions when the question of ethical vegeterianism has been discussed, but we are surprised that we have been perceived by some (including an animal activist) as having too much of a vegetarian slant.

Comments on Subject Matter

Many of our respondents wanted to see more hard data on farm and laboratory animal issues and, to be frank, so

TABLE 1 Rating of Journal's Impact*

	Excellent	Good	Moderate	Poor
Institutions	7	15	2	1
Individuals				
a) Res. Scientists & Veterinarians	13	19	8	3
b) An. Welf. Professionals & Activists	32	15	5	1
c) Other (e.g., attorneys, farmers)	9	10	3	2
TOTAL	61 (42%)	59 (40%)	18 (12%)	8 (6%)

***Only 146 returns contained information on identity of respondent**

TABLE 2 Does the Journal Need More or Less Objectivity

	More	Less	Stay the Same
Institutions	15	—	7
Individuals			
a) Res. Scientists & Veterinarians	34	—	8
b) An. Welf. Professionals & Activists	23	3	25
c) Other (e.g., attorneys, farmers)	12	3	14
TOTALS	84 (58%)	6 (4%)	54 (38%)

would we. Up until now, most of the hard data has appeared in the *News and Analysis* section with the rest of the *Journal* given over to opinion and review articles. However, we will have a number of original articles appearing in future issues, which will help to mitigate some of this criticism.

We have also had many requests for articles on animal population control, ranging from problems of urban strays to predators to rodent pests. We admit that we have had far too little material on this topic but hope to improve next year. For example, we have accepted a paper on feral dog control in Cyprus and have solicited two articles on the impact of spay/neuter programs on urban animal populations. We hope that this will stimulate a more detailed examination of animal control and shelter operations.

Behavior and ethology was another area that produced many requests for more articles. Respondents asked for material on the usefulness of ethological data in addressing animal welfare problems and the whole issue of sentience. In that regard, the Focus piece on pain and anxiety in animals in this issue of the *Journal* may be of interest. We do not have any plans to seek out contributions on animal behavior, but it is obviously a research area of great importance to the *Journal,* and, as such, will receive high priority.

There were many other topics which were mentioned by the respondents. Space precludes a discussion of all of them, but we would like to assure our readers that we have made a list of their requests and will use that list to establish priorities in the future. We would like to thank our readers for all the support we have received and urge you to continue to communicate your concerns and interests.

The Language of Animal Exploitation

Michael W. Fox

A detailed, cross-cultural linguistic analysis of terminology related to various forms of animal exploitation might give considerable insight into how professional and vested interest groups perceive and value animals and how sensitive they are about what they do. Dairy cattle, breeding sows, and laying hens have been called "production units" and "biomachines." These are examples of how language can be laundered to assuage guilt, gain public respectability, or avoid public ridicule. There are myriad other examples. Unwanted cats and dogs are "put to sleep," rather than killed; surplus pets are euthanized (which means mercy killing), rather than depopulated. Seals, deer, and other wildlife are "harvested" (as if they were apples) rather than slaughtered. Recently, farm groups have voiced their distress about the idea, advanced by some humane education groups, that we eat animals. They do not find this concept palatable, especially when addressed to children, and would prefer to see us talk of "eating meat." It is true that we do not consume whole animals—but meat *does* come from whole animals!

Scientists often use the term "sacrifice" in place of "kill" when speaking of laboratory animals. This usage represents a significant choice of terms, since it implies that the animals are dying for human benefit, or for the sake of the advancement of knowledge. I find the word "pet" demeaning when speaking of companion animals like cats and dogs, and animals that are denominated by the sterile term "specimens" by zoologists and naturalists can hardly be perceived as more than objects or things. Animals, even though they, like us, have gender, are rarely referred to as "she" or "he" but as "it." They are also deanimalized further by the use of such pronouns as "that," rather than "who" or "whom." Also, teachers of English, writers, journalists, and others could help by banishing from our vocabulary the demeaning inferences made about animals when they are used in reference to essentially human traits and shortcomings: *e.g.*, "pig," "swine," "sloth," "bitch."

The hypothesis that our language serves not only to distance us from animals, but also tends to reduce them to the level of insensitive objects, deserves testing. Such language also conveys an aura of respectability to ethically questionable forms of animal exploitation, and even sanctifies some forms, as in the "sacrifice" of laboratory animals.

News & Analysis

Mickey Revisited

Human beings are well known for their tendency to anthropomorphize animals—Walt Disney built a multimillion-dollar empire on this trait. A recent report (*J Soc Psychol 112*:161-162, 1980) describes a study performed on 228 undergraduates at a Tennessee University to investigate the tendency to associate human traits (fear, anger, love, sympathy, humor, compassion, happiness, vanity, sadness, and pain) with 36 different animals, including mammals, birds, reptiles, fish, and invertebrates. (It seems to us, in this regard, that there could be some argument about the delineation of some of these traits as exclusively human. Surely "pain" and "fear" are important components in an animal's interaction with and adaptation to its environment.)

The animals that were perceived as having the most human traits were the chimpanzee, dog, horse, and parakeet, while four were seen as having the fewest: snake, wasp, cockroach and earthworm. People tended to group animals into four categories, based on their degree of appeal to humans. The most favored were the furred animals, followed by the birds and fish/insect group and, finally, insects, reptiles, and worms. In general, women made more anthropomorphic attributions than men. In addition, those who were highly sensitized to human feelings were found to be much more likely to attribute human traits to animals. This indicates that there might be some validity to the Kantian notion that insensitivity to animals could produce (or reflect) insensitivity to fellow humans.

Defense Alternatives

The U.S. Department of Defense issued a revised directive (3216.1) in February 1982 concerning the animals used in DOD research programs. Among the requirements usually found in such documents, that the animals used in research and testing experience "no unnecessary pain, suffering, or stress," the directive also notes that:

a. "Alternatives to animal species should be used if they produce scientifically satisfactory results."

b. "The use of dogs, cats, or nonhuman primates in research conducted for the purpose of developing nuclear weapons is prohibited."

FDA Approves Contraceptive Dog Food

A new product, Cheque Medicated Dog Food, has been approved by the FDA for prevention of estrus in bitches. Upjohn, Inc., has been working in collaboration with the Carnation Company for 10 years to develop the product, whose active ingredient is mibolerone, a non-progestational steroid, which has previously been available in oral form as a food additive. Over 2,000 female dogs were used in clinical tests of the new product, in addition to numerous field tests in other bitches.

However, the new contraceptive food is counterindicated for dogs with any history of liver or kidney problems, since malfunction of these organs can slow up the rate of excretion of the product's bioactive steroid. Also, Upjohn warns that Cheque should not be given to dogs "before the first estrus period, and should not be used to abbreviate a period." Each 6½-ounce can of dog food will contain 30 or 60 micrograms of mibolerone; the dog's weight will be used to determine which dosage is administered.

Cheque treatment should be started 30 days before the onset of heat, and can be continued for 1 year. An animal

may come into heat as early as 7 days after cessation of treatment, but normally 60 to 90 days elapse before heat resumes (From *DVM*, May 1982).

Those Ultrasonic Devices for Pest Control

Following the demonstration that rodents were capable of emitting ultrasound and may in fact use ultrasound for communication, several commercial ultrasonic devices for repelling rats and mice have been marketed for food-storage warehouses, grain elevators, and other facilities where the use of rodenticides may be impractical. The conditions under which these devices produce their maximum effects have not been investigated. For example, one could hypothesize that food-deprived resident rats that have been continuously exposed to ultrasound might be extremely difficult to repel.

In their report, Shumake and several colleagues at the Denver Wildlife Research Center investigated the effectiveness of ultrasound repellers (*J Wildl Manage 45*:148-155, 1982). They found that food consumption was significantly reduced with all devices tested when food was plentiful, but under other conditions their efficacy was highly dependent upon ultrasonic frequency, intensity, and the preexisting rodent-infestation condition. The authors concluded that ultrasound devices would be most useful as adjuncts to traditional rodent control.

NIH Animal Welfare Guidelines

In the wake of the prosecution of a Maryland research scientist (*Int J Stud Anim Prob 3*(3):219-227) and under pressure from continuing congressional interest in the topic, the National Institutes of Health is moving ahead on a variety of administrative proposals aimed at tightening controls on the use of laboratory animals. According to an article in *NIH Week* (June 18, 1982), a task force has presented the following proposals to the NIH Extramural Programs Management Committee.

1. Every grantee institution should have an Animal Care and Protection Committee comprised of at least five members, one of whom is a veterinarian with laboratory animal experience and another who is independent of the institution and can therefore serve to represent community concerns.
2. Every research proposal involving animals should be approved by the Committee before being submitted to NIH.
3. Site visit teams should inspect both the laboratory *and* the animal housing facilities.
4. Investigators should make note of any major protocol changes in their annual reports.
5. Institutions should report to NIH any major changes in accreditation status, any misconduct by investigators, or any protests related to animal welfare made by the public.
6. NIH should launch a 1-year program of 30 site visits, in order to check on institutional animal facilities.
7. The Institutional Committee should launch an immediate investigation of any complaints about misconduct involving animal use and should decide within 48 hours whether the research ought to be permitted to continue.

It is probable that these proposals will be modified in some ways before they are endorsed as official NIH policy, but it is clear that some of the measures in the Walgren bill (H.R. 6245) have caught the attention of NIH.

Mung Beans May Replace Animals for Screening New Drugs

A new *in vitro* screening test for anticonvulsant drugs, which makes use of enzymes derived from the roots of mung beans, has been devised by John Gilbert and Marjorie Watson of Heriot-Watt University in the U.K.

The first step in development of the new screening procedure involved unrav-

eling the basic biochemistry underlying the effectiveness of the drugs that are already in use to treat epilepsy and similar disorders. Gilbert, working in collaboration with M.G. Wylie, found that these drugs function by inhibiting a magnesium-activated adenosine triphosphatase (Mg^{++}-ATPase) in nerve terminals in the cerebral cortex. This bit of information suggested the possibility of a highly specific test for assessing the potential of new anticonvulsant compounds: an *in vitro* assay of the effect of these agents on the action of the Mg^{++}-ATPase. But current methodology entailed preparation of the enzyme from rat brains, and use of rats created two major problems: (1) use of a great number of animals and (2) some lack of specificity, since convulsions induced in rats seems to be qualitatively different from those that occur spontaneously in humans.

However, Gilbert and Watson knew that there was a similar group of Mg^{++}-ATPases in the roots of several plants: sunflowers, potatoes, and mung beans. But the ATPases from these plants gave conflicting results—some of the recognized anticonvulsants did inhibit enzyme activity, but other *non*-anticonvulsant drugs did too. Another group of closely associated enzymes from mung bean roots, the nitrophenylophosphatases, gave more promising data. Nineteen proven anticonvulsants were tested for effect on the plant enzymes. In general, a small but nevertheless statistically significant change—an increase in enzyme activity (as contrasted with the decrease seen with ATPases)—was observed. Conversely, drugs without anticonvulsant properties had no effect, or were inhibitory.

Subsequent "double-blind" tests using additional anticonvulsants have yielded similarly reliable results. Other classes of drugs may also be amenable to *in vitro* screening with plant enzymes. An important group of antidepressant agents, the tricyclics, seem to have an opposite effect to that of the anticonvulsants on mung bean nitrophenylophosphatase activity—they routinely inhibit the action of these enzymes. (From *New Scientist* 94 (1309):702, 1972.)

A Lift for "Down" Cows

Some dairy farmers have voiced concern over the inhumane treatment of sick and injured cows which, rather than being slaughtered on the farm, are transported to slaughter while still alive. The profit that accrues from this practice tends to vary, but some packing plants offer over $100 for injured animals. Cattle that are sick or suffering from fractures and other injuries are winched onto trucks for transportation, with no first aid provided prior to loading.

A complaint by one Wisconsin dairy farmer to the *Journal* led to the following response from E.D. Baker, Administrator of the state's Meat Inspection Division. The action taken by the state clearly demonstrates recognition of a significant welfare problem and itemizes some of the steps that need to be taken in all of the states, to ensure that "down" cows are slaughtered on the farm.

The Meat Inspection Division, Wisconsin Department of Agriculture, Trade and Consumer Protection, has taken the following actions on down cows:

1. Supported legislation to require the killing of down cows prior to loading for pet food or rendering. The law has been enacted and is being enforced.

2. Vigorously enforced Wisconsin statutes that prohibit the slaughter of uninspected diseased animals at custom slaughter establishments.

3. Developed guidelines which describe animals unfit for slaughter and made distribution to plant owners, truckers, and practicing veterinarians.

4. Implemented new federal regulations for humane slaugher.

5. Condemned unfit animals promptly on antemortem inspection.

These measures have, reportedly, significantly increased the number of animals slaughtered on the farm for which we have little control. We feel that considerable progress has

been made in the control of unfit down animals, but owners will continue to have injured animals which, if handled promptly, are fit for food and have nearly the same monetary slaughter value as a normal animal.

Bird Banding Bad for Birds?

At the beginning of this century, bird banding was carried out by only a few private enthusiasts who were interested in the study and protection of migratory species. Then, in the 1930's, the federal government established large-scale banding programs to keep track of waterfowl for game management purposes. Banding programs have, according to their supporters, enabled ornithologists and ecologists to obtain valuable information on migration routes, bird navigation systems, and the effects of pesticides and other environmental contaminants. Kathleen Anderson, director of Manomet Observatory, one of America's most sophisticated banding operations, argues that "banding is a tool that enables biologists to get information they could acquire in no other way" (*New York Times,* July 25, 1982). For instance, banding studies have shown that the loon population of North American lakes has declined drastically and this finding, in turn, led to the discovery that the fish population had dropped off due, at least in part, to acid rain. In addition, banding studies have demonstrated that the health and reproductive success of raptors are directly related to the amount of pesticides and toxic chemicals in the birds' habitat.

On a lighter note, the vagaries of banding have provided the grist for many whimsical human-interest stories. Thus, Samson Mugande in Zimbabwe found a dead vulture with a band (ring) and reported it to the authorities. He was sent a copy of the analysis and accordingly wrote to the person who banded the vulture as follows:

I was very happy when I heard that it was you who ringed the vulture... All my family were very pleased... and they committed you as a very famous man in South Africa. And I am very famous here in the Zimbabwe (*Vulture News,* No. 5, 1981).

Nevertheless, not all aspects of banding find favor with the growing number of active bird watchers. Two practices in particular, the in-hand examination of wild birds and the use of live decoys for trapping, are being criticized by many bird watchers. And some scientists have censured the Fish and Wildlife Service for being too lenient in issuing banding and petting permits. The Humane Society of the United States does not have a formal position on bird-banding, but it does object to certain practices, such as the use of live birds for the capture of raptors (*New York Times,* July 27, 1982). As in many other areas of human-animal interaction, humane issues related to bird banding are now coming under much closer scrutiny, and bland assertions about scientific and other benefits are no longer sufficient to allay these concerns.

The Rites of Passage of a Hunter

The January 1982 issue of *Fur-Fish-Game* reports on a study of the developmental stages of hunter psychology, as investigated by Robert Norton and Robert Jackson of the University of Wisconsin. After observing hunters and their hunting patterns in the field, Norton and Jackson interviewed them about their attitudes toward their activities. They found that, in general, hunters tend to demonstrate the traits of one of five stages:

1. Novice hunters seem to derive their primary pleasure from the mere act of shooting itself. Thus, this first period is termed the "Shooter Stage."

2. The "Limiting Out Stage" comes next. At this point, hunters become absorbed in the goal of meeting the legal limit on number of animals killed. Success and self-esteem can thereby be measured and compared with the relative success of others.

3. In the "Trophy Stage," the hunter has separated himself sufficiently from the pack that he comes to concentrate on his own personal objective, usually the killing of a particular species.

4. The "Method Stage" is characterized by an intensity that is nearly a religious fervor about hunting. Hunters in this stage are obsessed with what is latest and most lethal in equipment, dogs, and the like, and are most concerned about *how* an animal has been killed.

5. Norton and Jackson's last stage, the "Sportman Stage," which is rarely attained by anyone under 40, comprises those hunters who have "mellowed out," who no longer have to prove anything to anyone, and whose pleasure stems mainly from their "total appreciation of nature."

But the literature (American, that is) may suggest avenues for further investigation by psychologists like Norton and Jackson. For example, in William Faulkner's novella, "The Bear," the hunters seem to have reached a hypothetical *sixth* stage of hunting behavior. Through countless years of watching and stalking the ancient bear, the hunters have achieved an intimate relationship among each other and with the animal that is rudely destroyed when the bear is killed by a blundering, misunderstanding member of the hunting party. The Faulkner story therefore raises an interesting topic for research: a careful study of the psychological development of ex-hunters.

Results of the First U.S. Trial of the Quantock Group-Pen System for Raising Calves

The first quarterly issue of the *Journal* (*3*(1):14, 1982) made note of an upcoming U.S. test of the Quantock group-pen system, as a joint venture of the British firm Volac Limited and the U.S. Corporation, Provimi. The actual trial began in December 1981, in Wisconsin, under the management of Quantock's stockman, Chris Deimert. The objectives of the study were to find out if the Quantock system could be profitably adapted to the very different conditions in the U.S., such as climate, diet, and calf breed.

The *Journal* contacted the President of Quantock, Philip Paxman, and asked if he could send us some information on the results of this cooperative venture. The following are excerpts from a letter he was kind enough to send us (dated June 22, 1982; the appended Table 1 is taken from the May 1982 edition of the Volac newsletter, *A Message from Quantock Veal*).

In the first trial of the Quantock system in America, 83 Holstein bull calves with an average weight of 114 lb were purchased on December 22, and they were slaughtered 98 days later. During the course of the trial one calf died of pneumonia, but there were no other losses. The physical performance of the calves was satisfactory, and feed consumption and growth rates were within 1 percent of the targeted figures based on British results. The growth rate and health of the calves, as reflected in the cost of veterinary treatment, were both superior to crated calves reared at the same time. There were, however, some problems, in particular, with the environment within the building during the very cold weather in January and February. The building had not been fully modified in accordance with our U.K. practice and the calves were, in effect, reared in a controlled environment which it was difficult to maintain satisfactorily. There was a considerable amount of condensation, and at times the bedding became wet, resulting in a somewhat dirty appearance of the coats of some of the animals.

The Quantock Calf Feeders worked satisfactorily without any mechanical problem throughout the trial, and the diets proved palatable and highly digestible. Quantock's English feed formula was used to feed half of the calves as a controlled diet, and these achieved a particularly high conversion ratio, just over 1.6 lb of feed per lb of live weight gain, but because our English formula is more expensive these calves actually made less profit than crated calves. The other half of the loose-housed calves were fed a proprietary American for-

TABLE 1 Physical Performance Data — Quantock Loose-Housed Trial

	Pens 1 and 2 (Volac Feed)	Pens 3 and 4 (Provimi Feed)	Crate Calves
Initial live weight (lb)	114.4	115.8	105.96
Final live weight (lb)	368.93	353.03	367.20
Growth	254.53	237.25	261.24
Daily live-weight gain (lb)	2.59	2.42	2.19
Cold hide-on carcass (wt., lb)	254.19	243.25	257.0
Cold hide-off carcass (wt., lb)	228.77	218.93	231.3
Food consumed per calf (lb)	416.54	417.33	443.55
Food conversion ratio	1.64	1.76	1.70
No. calves start	43	39	432
No. calves finish	43	38	405
Mortality	0	1	16-3.70%
Culls	0	0	11-2.32%
Age to slaughter (days)	98	98	119

mula, which was substantially cheaper and, although the performance in terms of conversion ratio was not quite as good, it sustained growth rates substantially higher than the crated regime. The bedding used, which was wheat straw, proved costlier than the maintenance of conventional crates, and it would be desirable to find a cheaper form of bedding such as maize cobs to improve the profitability of the system.

I have now incorporated a U.S. corporation under the name of the Quantock Corporation, which is establishing an independent trial unit for the Quantock system in Wisconsin, under the management of Mr. Chris Deimert, the English stockman who conducted the first trial. Unfortunately, he is currently suffering from ill health, but as soon as he recovers it is our intention to stock this unit and make it available for demonstration purposes. At a later stage we hope to construct a purpose built unit for the Quantock system, designed to take fully into account the climatic extremes in the mid-West.

The association between my Company and Provimi, which was for a 6-month duration for the purpose of carrying out the first trial, has now been terminated on a mutually friendly basis, and you will be happy to know that Provimi will be continuing their investigations of the Quantock system, and the fact that two units will now be operating independently should allow a larger number of aspects to be considered.

American Psychological Association & Dr. Taub

The 90th annual convention of the American Psychological Association (APA) was held in Washington almost 1 year after the police seized monkeys from a Maryland laboratory and charged Dr. Taub, the Director of the laboratory and a research psychologist, under the Maryland anticruelty statute (see *Int J Stud Anim Prob* 3:219-227). Since then, the APA has provided Taub with both moral and financial support ($5,000) prior to the outcome of his appeal, in which 1 count of animal cruelty was upheld by the jury.

The APA actions were the subject of considerable debate in an open forum at the annual convention. Apparently many APA members, some of whom occupied influential positions within the Association, were upset at the manner in which the support was given. APA officials were defensive in the face of such criticism and argued that their support was given to ensure a full and fair examination of all the issues surrounding the Taub case. In particular, they stressed that there was no presumption of guilt or innocence. However, the APA's Psychology Defense Fund authorized a further grant of $5,000 to Dr. Taub's Institute on August 21, 1982, one and a half months after he had been found guilty of 1 count of cruelty.

Separating the Dogs from the Coyotes

During the 3-year period from 1975 to 1977, J.M. Schaefer, R.D. Andrews, and J.J. Dinsmore investigated the realities behind the claims of southern Iowa producers about losses of sheep to coyotes and dogs. Among other things, the study (published in *J Wildl Manage* 45(4):883-893, 1981) attempted to compare the relative validity of data from several reporting methods — a one-time questionnaire, monthly postcard surveys, and records of domestic-animal claims — as opposed to the findings from necropsies performed by the authors.

Forty-one percent of the questionnaire respondents reported that they had had one or more sheep killed by predators in 1975 (average, 7.6 sheep). Of this group, 63 percent attributed all predation losses to coyotes, while 25 percent reported that dogs were responsible; only 12 percent attributed predation losses to a mix of both coyotes and dogs.

However, other survey methodologies provide a somewhat different view. Both the field necropsies of respondents' sheep and the domestic-animal claims records revealed that dogs killed more sheep per reported incident and more sheep per rancher than did coyotes. Further, a seasonal pattern was observed with coyotes (80 percent of the coyote incidents occurred between May 1 and October 1), while dog predations seemed to occur at random times throughout the year.

In 94 percent of all sheep mortalities that were autopsied by one of the authors, the author's determination of cause of death agreed with that of the sheep producers. Nonetheless, the three authors thought it wise to draft a "how-to" pamphlet for ranchers, *Recognizing and Reducing Sheep Predator Losses* (available from the Iowa Cooperative Extension Service, Ames, IA 50011). This document provides a detailed manual for piecing together the several clues that can be used to discriminate between deaths due to coyotes and those attributable to dogs.

The fundamental signs that indicate that a predator may be responsible for recent deaths include:

- Recent predator problems in the area
- Eccentric behavior of sheep
- Signs of struggle
- External wounds.

For example, predator attacks on pastured sheep will often induce the sheep to return to the nighttime bedding area, whether it is located in the pasture or in a corral. Sheep that have been subjected to several attacks may also show reluctance to leave an enclosure, even during normal feeding times.

There are some recognizable indicators that a coyote, rather than a dog, has been responsible for a particular sheep killing. One point that is stressed repeatedly in the pamphlet is the broad range of behavior patterns among coyotes, such that they must always be considered, and dealt with, on an individual basis. Some coyotes may kill sheep on a regular basis, while others may live out their whole lives and never touch one sheep. Dogs, however, seem to enjoy attacking sheep as an end in itself, rather than actually seeking a required food source. Often, many sheep will be injured by the typical scatter-shot attack of a dog. This pattern may explain the finding in the authors' survey study, that dogs were reported by ranchers to have killed more sheep per incident than did coyotes.

How to tell dog tracks from those of a coyote, how to differentiate hair and feces, feeding patterns, and kinds of wounds inflicted are also covered. Then the authors list some of the newer ways of protecting sheep from all predators, such as confinement, guard dogs, and aversive devices.

One interesting aspect of the whole coyote problem that emerges from these two publications is that it is a lot easier to get compensation for sheep lost to coyotes than for those killed by uncontrolled dogs. In the latter case, the rancher must prove, with substantiation by a witness, that a specific dog was the culprit. This, it would seem, is no easy task.

Focus

The Problem of Pain: What Do Animals Really Feel?

The Limits of Language

Much of the contention and confusion that seem inevitably to arise whenever the subject of pain in animals comes up appear to stem principally from problems with the word "pain" itself. When used to describe responses in humans, "pain" can mean any subset of an incredibly broad spectrum of sensations and emotions, ranging from the instantaneous, galvanizing effect of a dentist drill hitting the nerve in a molar, to more airy notions such as the "pain" of rejection or "painfully" embarrassing situations. Humans even use concepts as abstruse as the German term, *weltschmerz,* or "world pain," which denotes a vaguely defined kind of sentimental depression or despair.

Few people today would attempt to reiterate the position of the seventeenth-century philospher Descartes, who held that animals, since they lacked the god-like element of soul, were simply unreasoning machines. Nevertheless, there is a pervasive reluctance among the great majority of the scientific community, many of whom use live animals on a daily basis for research and toxicology studies — to make any firm or concrete statements about the nature of the pain experience in animals. Their position seems to be partly based on the assumption that pain in humans must be considered *a priori* as a far more elaborate nexus of mechanisms and subsequent reactions, especially in terms of emotional and intellectual consequences, than could ever be considered possible in animals. In most formal scientific presentations, though, this assumption usually remains obscured by a smokescreen of insistence upon the necessity of accumulating more and more objective data to complete a highly detailed picture of the neural circuitry of the various animal species.

In his introduction to an American Veterinary Medical Association-sponsored symposium, "Pain Perception in Animals" in April of this year, R.L. Kitchell (University of California, Davis) summarized the essential elements of this position. He asserted that we would probably not have any reliable methods for "objectively" demonstrating that pain — as we know it — occurs in animals for many years, until all of the nerve pathways and central nervous system (CNS) interconnections related to pain have been teased out in humans, as well as in the wide range of phylogenetically diverse species that are used in laboratories. Until that time, he cautioned, we should be careful to speak only about presumed "noxious stimuli" in animals, and that we ought to be wary about making any direct inferences that what we commonly think of as pain occurs as a direct result of applying these sorts of stimuli.

But on the other hand, Kitchell also stated categorically that "pain is a subjective phenomenon, which is unique to each of us." So a troublesome question arises when the standard scientific approach to the study of pain is used without consideration of other ways of attacking the problem: Why bother to continue collecting ever-more sophisticated data, obtained by doggedly subjecting experimental animals to years of onslaughts of "noxious stimuli," in order to learn everything possible about nervous pathways, neurotransmitters, and the like, if the whole phenomenon of pain can never really be subjected to rigorous study at all? Must it not always remain a purely subjective experience, whose qualities and intensity cannot be communicated precisely by humans, let alone by nonspeaking animals?

On closer inspection, in light of what we know *now* about pain in animals, this sort of conceptual paradox becomes much less of a problem. We already have

a highly detailed picture of the mechanisms of pain reception and conduction in the peripheral nervous system and a somewhat more sketchy, but nevertheless substantial, body of knowledge about the interpretation of incoming pain signals in the CNS. In addition, we have comparative data on how species of varying levels of complexity perceive and respond to noxious stimuli. And we have learned that there is no species in which pain perception, and the subsequent response, is a simple process. For example, it has recently been discovered that a great number of species—even those quite phylogenetically remote from humans—secrete a class of biochemicals that are used to make sophisticated and minute adjustments in selecting which pain signals are transmitted to the CNS, and at what level of intensity. Attacking the problem from a different perspective, behaviorists have designed elegant experiments, using avoidance mechanisms, that can test an animal's threshold to various kinds of pain stimuli and furnish answers to questions about issues such as memory of pain, and the amount of "anxiety" an animal feels when placed in an environment where a painful stimulus was previously applied.

With all this accretion of knowledge from older work as well as from more recently developed techniques, we can be reasonably certain that animals, when exposed to noxious stimuli, do indeed sense something that contains many of the elements that humans would list as components of consequences of pain. These include physical discomfort, negative affect, and the formulation of avoidance strategies. While it may present a real challenge to learn how to translate the "language" (internal and external signals) that each individual species uses as part of its own particular way of perceiving and responding to painful stimuli, especially when a given species is remote from humans, it can be, and is being done. Further, these efforts can be of immediate use for drafting workable guidelines on the kinds and levels of pain laboratory animals ought to be allowed to endure.

The Basic Physiology of Pain—Nociceptors

For all species, pain can be considered as an adaptive response that functions to promote the avoidance of injury and potentially dangerous situations, as well as to protect damaged parts after an injury has occurred. Sharp pain tells an animal that it has entered into a dangerous situation. Dull, chronic pain indicates a need for rest and self-protection (*Report of the Panel of Enquiry into Shooting and Angling,* RSPCA, U.K., 1980). Only the intractable pain of diseases associated primarily with old age (such as cancer) appears to have little adaptive value. But under natural conditions, few animals (including primitive man) would survive long enough to experience this kind of pain.

Pain is first perceived in the body via specialized receptors of the peripheral nervous system, termed nociceptors. Located in the skin, these appear to differ very little from similar receptors also found in skin, which detect other sensations such as low-intensity heat and pressure. Although similar structures have been found in other vertebrates including fish, their anatomical similarity to other receptors has so far made it impossible to tell if they are responsible for sensing and transmitting "noxious stimuli." L.E. Krueger (University of California, Davis) is utilizing the electron microscope to elucidate the specific structure and function of the various types of nociceptors. Kreuger also uses microelectrodes, in conjunction with horseradish peroxidase and lectin transport techniques, to study the stimulus threshold of single nociceptor fibers, the conduction pathways of individual fibers after stimulation, and the average conduction speeds of the different fiber types. Among other findings, he has discovered that each spot on a nociceptor axon has a different level of excitability—excitable zones are intermixed with unexcitable areas in a highly complex pattern.

Physiologically, the nociceptors differ from other receptors in that they have a higher threshold for stimulation.

Sensations such as heat must reach an intensity sufficient to produce possible damage to tissue before impulses will begin to pass along nociceptor axons. The structure of the nerve fibers has been correlated with the type of pain perceived. The A-delta fibers, which are coated with thin myelin sheaths (and are therefore better conductors of impulses), are associated with rapid conduction of impulses and sharp pain. The activation of unmyelinated, or C fibers (which are slower conductors) tends to be associated with aching, long-lasting pain.

When cells near the nociceptors are damaged, they release many kinds of biochemicals. Among these is a specific protein (peptide), bradykinin, which serves as the chemical transmitter that causes the pain receptor to discharge. When injected into humans, bradykinin causes instantaneous and extreme sensations of pain, even in the presence of concurrent anesthesia. Extrapolating from these data, we can say that a test for the presence of bradykinin might constitute one type of reliable proof that a given species possesses the basic rudiments of biochemical pain transmission.

A second peptide, substance P, has also been implicated in the transmission of nerve signals indicative of pain. It serves as the neurotransmitter between the afferent pain-sensing nerve and the spinal cord. The presence of this biochemical could therefore possibly serve as a second indicator of pain-sensing mechanisms in a species.

Impulse Transmission Through the Cord

The impulses that originate at the nociceptors located in the skin travel to the spinal cord, via the dorsal roots. The axons of these nerves may extend directly to the brain or they may make various kinds of interconnections with other spinal cord cells, and the intensity of the pain signal may be modified in the process. Pain signals then proceed on to the brain, through one of several ascending tracts of the cord.

It is at this point in the anatomy of impulse transmission that some interspecies differences appear. The lateral spinothalamic (or neospinothalamic) tract, which carries impulses to the thalamus of the brain, is highly developed in primates, but only rudimentary in some species like the cat (J. Vierck, *J Am Vet Med Assoc 168*:150-513, 1976). This tract seems to be most important for fast conduction of data related to localization, orientation, and quick reactions to potentially damaging stimuli. In contrast, the spinoreticulothalamic (paleospinothalamic) tract is more likely to carry information related to activation of arousal and emotional systems, since this tract terminates in the brain areas (the limbic system and hypothalamus) that participate in the mediation of emotions and expression.

In rats, K.L. Casey (University of Michigan) reports that areas of the cord containing *both* the neospinothalamic and paleospinothalamic tracts can be severed, and the animals will still respond to painful stimuli, since in this species pain conduction pathways that pass directly to the brain are located in the peripheral nerves, as well as in the cord.

The several pain conduction tracts of the cord terminate in various areas of the brain, such as the reticular formation, a fundamental relay center which controls respiration, heart activity, and blood pressure and which may be involved in the conscious perception of pain (T.A. Yoxall, 1978). Also involved is the limbic system, which is concerned with factors such as memory, attention, and emotion: One component of the limbic system is the thalamus. Finally, through connections from the thalamus to the higher centers of the brain, or cortex, pain can influence thought and decision-making processes.

Here, again, we see some differences among species. For example, nerves of the spinothalamic tract end in different areas within the thalamus, depending upon the type of animal. In primates, the tract terminates in the ventral posterolateral (VPL) nucleus of the thalamus, whereas in carnivores it ends in a thin

area that forms a kind of shell around this nucleus. In rats, terminations of spinothalamic nerves are also found predominantly in the VPL nucleus, but in an area that is located more toward the front of the animal's head.

W.D. Willis (University of Texas Medical Branch, Galveston) reports that the area of the thalamus that is activated seems to be correlated, to some degree, with the nature and intensity of the behavioral response that ensues after the application of a painful stimulus. However, it is not possible at this time to make sweeping generalizations about how different animal species feel in the presence of noxious stimuli, or of how they are likely to react in terms of behavioral responses, solely on the basis of fine differences in neurophysiology, since we simply do not know the real significance of many of these differences. Perhaps most important, we have not yet discovered what degree of overlap in function and response may exist among the different anatomical areas of the cord and brain that are used to convey perceptions of pain in the various species. Although traveling on a different tract, to a different location in the brain, an impulse may be conveying similar information and may elicit a similar set of responses.

The relationship between what we know about the ascending pathways of pain versus what we do not yet know might be compared to the study of the geography of some newly discovered area. We have the basic maps of the region drawn up in pretty elaborate detail, and we know something about the various peoples who live in the region, but not so much about how the individuals in each culture function, and very little at all about how the various cultures interact. Similarly, the work of tracing the pathways of nociception in animals appears to be making steady progress. We know a lot more than we did 10 years ago about the fundamental similarity in structure and function of these pathways among the higher vertebrates, and of the identity of the biochemicals used in transmission of pain signals across nerve synapses, but far less about the roles and functions of individual nerves and the inter-relationships among the various CNS components that are involved in nociception. Nor are we any more certain that, having obtained these data, we will be any closer to making succinct lists of the differences between the meaning of the word "pain" to a human, as compared with what animals may sense, feel, and think.

A Few Other Wrinkles — Endogenous Analgesics and Psychological Effects

One of the most important scientific discoveries of the last decade was the recognition that the perception of pain was not a one-way street, running in a simple pathway from nociceptor to cord to CNS centers. In fact, pain perception is a two-way street, because the descending spinal never tracts that connect the various CNS centers to levels in the spinal cord can modulate input from the afferent fiber. These nerves appear to work by releasing neurotransmitters coming in from the periphery (L.R. Watkins and D.J. Mayer, *Science 216*:1185- 1192, 1982). E.A. Carstens (University of California, Davis) has hypothesized that this kind of endogenous analgesia might work to provide a critical edge in the selective survival of an individual by permitting an animal that has been severely hurt to continue to function and to fight, if that is necessary, in spite of severe pain.

Several classes of pain-mediating chemicals have been isolated. These include the endorphins, serotonin, and 5-hydroxytryptamine. Of these, we know most about the endorphins. Chemically, endorphins are peptide molecules that are structurally similar to morphine. Like morphine, they bind to appropriate receptor sites in the brain stem and cord to block the transmisssion of pain impulses. Also, their effect is countered by the same agents that antagonize the action of artificial opiates, for example, the drug naloxone. A close association has been noted between nerve endings that contain the pain impulse neurotransmittter, substance P, and those that contain one type

of endorphin, the 5-peptide enkephalin. From these findings, it is tempting to postulate that the enkephalin receptors, as well as those for other opiates, may be located on the nerve endings that contain substance P, and that these opiates therefore function by blocking the release of substance P (*Report of the Panel of Enquiry into Shooting and Angling*, RSPCA, U.K., 1980). The sophisticated mechanism of pain mediation by naturally occurring opiates is not unique to the higher vertebrates: endorphins have been isolated in species as phylogenetically distinct from humans as the earthworm (J. Alumets *et al., Nature 279*:805-806, 1979).

L.R. Watkins and D.J. Mayer (*Science 216*:1185-1192, 1982) recently studied the pain-moderating role of another kind of endogenous system, a system that does not seem to be activated by endorphin, since its effects are not reversed by the opiate antagonist naloxone. Activity of this second system has been localized to a specific region of the body. In rats, electric shock to the *front* paw induced endorphin-mediated analgesia, which was reversed by naloxone, but in the *hind* paw, naloxone had no effect on painkilling activity. However, the precise pharmacological basis for this type of analgesia remains unknown.

In addition, analgesia can be produced by a whole range of other mechanisms. Direct electrical stimulation to the brain can activate both opiate- and nonopiate-mediated analgesic pathways. Acupuncture and the analgesia induced by long-duration shock to all four paws of the rat seem, at least in part, effects of hormones, since surgical removal of the pituitary or adrenal glands reduces or abolishes the effect.

Interestingly, pain reduction caused by these mechanisms doesn't seem to be coupled with any sense of euphoria, as is the rule with morphine administration. E.A. Carstens (University of California, Davis) has found that when an animal is allowed to self-apply electrical stimulation to induce analgesia, it will only do so when a noxious stimulus is present, implying that the stimulus is not in itself pleasurable. He also suggests, therefore, that this sort of self-stimulation apparatus might provide us with a tool for obtaining clear-cut evidence of when an animal is experiencing pain.

Anxiety and Suffering

Another class of receptors, which selectively bind the anxiety-reducing drugs, the benzodiazepines (Valium is perhaps the best known of these) has been localized within the brains of many animals. The existence of such sites suggests that animals may be producing a natural biochemical to counter the affect of anxiety, just as the endorphins work to counter pain impulses (*Sci News 117*:164, 1980).

Binding sites for benzodiazepines have been found in brain tissue of mammals, rodents, reptiles, and bony fishes (*Brain Res 141*:342-346, 1978), but not in cartilaginous fishes or invertebrates. However, since we do not yet know the whole story relative to the pharmacology and benzodiazepine binding, it may well be that invertebrates are also producing biochemicals that are analogous in structure and function to the yet-unidentified anti-anxiety agent secreted by vertebrates.

Goodman and Gilman, in the standard reference work *The Pharmacological Basis of Therapeutics* (1975) assert that:

> *The effects of the benzodiazepines in the relief of anxiety can readily be demonstrated in experimental animals. In conflict punishment procedures, benzodiazepines greatly reduce the suppressive effects of punishment. However, anxiety in the rat and man can hardly be equated* (emphasis added).

In light of the research demonstrating the close analogy of the physiological roles played by bradykinin, substance P, and the endorphins in a broad spectrum of invertebrates, this last sentence seems a rather premature and cavalier conclusion. It seems far more likely that just as the detection of certain neurotransmitters furnishes evidence for a similar pattern of sensation and response to pain in

humans and animals, so the discovery of benzodiazepine-binding sites in other species provides a possible indication that something akin to the human emotion of anxiety is experienced by most vertebrate animals.

Corroborating evidence for an anxiety state in animals is provided by new work on "anti-Valiums," drugs that block the action of benzodiazepines (*Science 216*:604-605, 1982). One such agent, beta-carboline, induces wakefulness in rats but, unlike amphetamine, does not increase motor activity. Beta-carboline is also being tested in animals to determine whether it has anxiety-producing effects, by observing the animals' behavior, specifically, their preference between a dark and lighted chamber (under standard conditions, the light tends to frighten them).

Finally, when addressing the problem of pain, the whole issue of the role of the higher CNS centers in mediating pain signals must be considered, especially since there are innumerable anecdotal reports of bizarre responses to traumatic injury, in both animals and humans. Soldiers in the Yom Kippur War, for example, when interviewed about their initial reactions to severe injuries, described them as painless and only mentioned other simultaneously occurring stimuli, like loud noises.

But What Does It All Mean?

Even if we were to consider only the data presented in this brief overview, it would seem that we have already garnered enough "objective" data to formulate plausible hypotheses concerning the unbroken phylogenetic continuity of mechanisms for perception and response to noxious stimuli among animal species. Vertebrates show homology in terms of nervous structure and function, and most of the biochemicals identified as playing an essential role in pain impulse transmission and modulation have been found in species as rudimentary as earthworms. Further, on the basis of these and similar kinds of findings, several participants at the Symposium on Pain Perception in Animals in New Orleans admitted (in private discussion) that the old subjective-objective dichotomy, as employed by scientists such as Dr. Kitchell, emerges as empty sophistry. J.C. Liebeskind (University of California, Los Angeles) commented: "I see no difference in the appreciation of pain between man and animals. In both cases, we must rely on inferential data. Humans use language, while animals use behavior."

C.J. Vierck (University of Florida) stressed the fact that a knowledge of the specific pattern of the pain response in a particular individual is as important for animals as it is for humans. He asserted that reactions such as fear and depression, as consequences of pain, were continuous along evolutionary lines. Quibbling about whether or not the sensations and responses of animals to harmful stimuli were sufficiently analagous to human perception to permit us to convey the noble title of "pain" upon them was only a matter of semantic triviality. As another investigator put it, there is no "*a priori* reason to suppose that, in evolution, the perception of pain appears as a wholly new sensory phenomenon in man" (D. Pratt, *Alternatives to Pain in Experiments on Animals,* New York, Argus Archives, 1980).

Practical Consequences: The Formulation of Codes and Regulations

T. Wolfle (NIH), at the same symposium on pain in New Orleans, noted that, given the gravity of society's concern about suffering in laboratory animals, "we cannot wait until all the data on acute pain in animals are in" — even if these data *could* answer all of our scientific and ethical questions about pain — to begin addressing the issue of how best to regulate the allowable extent and intensity of that suffering.

However, efforts aimed at formulating workable guidelines on animal pain have foundered, in nearly every instance, on the problem of defining "pain"; even more difficulty arises with more nebulous words like "suffering."

In an article published in *Lab Animal* (*10*:36-38, 1981) F.M. Loew noted that

The words and phrases used to de-

scribe the part of animal experimentation objected to by many people, and therefore considered in the nation's regulations and standards, are:

pain and discomfort
pain or distress
suffering and injury
discomfort

He observed that "these words and phrases are subjective," so that "some have proposed that more specific descriptions be used in the Animal Welfare Act by the NIH." However, Loew also recognizes the validity of the counterargument that, since no set of regulations could ever be written so as to anticipate every possible permutation in experimental design, *broader* terminology may hold the key to successful minimization of pain. In the end, though, Loew recommends that self-regulation, *i.e.*, the thoughtful use of animals by scientists themselves, is the essential element in protecting these experimental subjects from unnecessary pain. But he also mentions, in passing, that a more specific set of guidelines for investigators of experimental pain in animals has been drafted by the Committee for Research and Ethical Issues of the International Association for the Study of Pain (published in the journal, *Pain* 9:141-143, 1980).

These guidelines emphasize peer review of procedures, careful observations of the animals' behavior as compared with behavior under suspected pain or stress, and measurement of parameters like electroencephalogram, eating and drinking, rank order in society, and body weight. The Committee also advocates the ultimate method for making a good guess about what an animal might be feeling during an experimental procedure: trying the painful stimulus out on yourself before subjecting the animals to the procedures.

A somewhat different approach is represented by the Swedish codes of practice on experiments in animals. Here, the regulations attempt to provide workable guidelines for scientists by dividing procedures into six categories, according to the degree of pain that is likely to result. The categories range from "no pain or only minimal and momentary pain" (category 1) to "experiments on unanesthetized animals (or only local anesthesia) where the animal is curarized or paralyzed" (category 6). Examples of typical procedures that are likely to produce each degree of pain are given for each category. Experiments in categories 1 to 3 require only notification of a regional committee (comprised of scientists, lab technicians, and lay people), whereas those in categories 4 to 6 require the Committee's formal approval (M. Ross, *Austr Psych 13*:375-378, 1978).

Although superficially divergent, these two approaches are similar in that they both aim at circumventing the problem of attempting to guess about the exact relationship between pain as sensed by animals and what is felt, under similar circumstances, by humans, and the consequential use of vague or abstract language in codes and regulations. In the Swedish code, the correspondence between human and animal pain is simply taken for granted; in the instance of the *Pain* guidelines, the investigators are advised to use themselves as their first experimental subjects, in order to get a precise fix on the degree of pain that is involved.

In the U.K., the dramatic increase in the use of experimental animals after World War II compelled a re-thinking on questions about their welfare, by scientists as well as the general public. One result of this self-examination was the formulation of the now-famous "three R's," in 1959, by Russell and Burch (*The Principles of Humane Experimental Technique,* London, Methuen): replacement, refinement, and reduction.

However, this approach, although highly useful both as a conceptual model and as a means of countering extremist reactions (both for and against vivisection), had little real effect on the day-to-day practice in laboratories.

So, in the early 1960's public pressure induced the government to establish a departmental committee to investigate the question of pain in lab animals. The Littlewood Committee decided that

the most workable way of defining pain was to consider it as three separate mental states, with three correspondingly different sets of symptoms (quoted from J. H. Seamer, *Vet Rec 110:* 341-344, 1982):

1. Discomfort — such as may be characterized by negative signs such as poor condition, torpor, and diminished appetite.
2. Stress — a condition of tension or anxiety predictable or readily explicable from environmental causes, whether distinct from or including physical causes.
3. Pain — recognizable by more positive signs such as struggling, screaming or squealing, convulsions, severe palpitation.

Although this "Littlewood formula" has not been formally incorporated into law, many of its components have been put into use, via administrative mechanisms, by the Home Office.

Conclusion

In one sense, the issue of pain in animals can be considered as an isolated element of the more general question of animal consciousness, a topic that is currently undergoing a relatively radical revision. J. Levy, a University of Chicago neurophysiologist, has decided — on the basis of neurological studies that demonstrate the continuity between the components that make up animal and human brains — that "we have no reason to suppose that there are any unique properties of the human organ of thought." He also reiterates the common insight that much of our medical research on animals *assumes* a continuity of consciousness from one species to another (*Psych Today 16*:36-44, 1982).

Surely, then, it would seem that we can say with some degree of certainty that the evidence furnished, to date, by the traditional measures of the classical scientific approach has only served to substantiate the theory that animals not only feel an immediate reaction to pain that is similar to our own, but also endure many of the longer-term ramifications of pain. Their "feelings" are communicated by their reactions, which constitute reasonably reliable, objective indicators of some type of adverse state. It matters little whether we choose to denominate this adverse state as "pain," or decide to call it something else and reserve the word "pain" for usages that contain more subjective elements and are thus only describable in language, thereby limiting its use to the human realm of experience.

Extrapolating further from this conclusion, we can say that "pain," as a response, should perhaps best be considered on a species-by-species basis. For example, vocalization as a reaction to noxious stimuli is probably of importance only to relatively socialized species, either to warn others in the group or to get assistance from them. In addition to the adoption of some approach that integrates the best features of the Littlewood formula, the Swedish code, and the *Pain* guidelines, it might be a good idea in setting up policy on animal experimentation to admit that there are some very real differences among species, in terms of their internal (neural and biochemical) and external (behavioral) indicators of pain. What we may need, then, is a multiplicity of handbooks on animal pain, for each of the several species that are commonly used in laboratories, that would set forth general guidelines on care, along with the specific signs of pain that ought to be carefully monitored for that species and what is known about the idiosyncrasies of administering anesthesia to the animals.

As Peter Medawar has stated (in *Hope of Progress,* Methuen, 1967, p. 72)

> *I think that the use of experimental animals on the present scale is a temporary episode in biological and medical history.... In the meantime, we must grapple with the paradox that nothing but research on animals will provide us with knowledge that will make it possible for us, one day, to dispense with the use of them altogether.*

Until that day arrives, it is imperative that we formulate workable guidelines for using animals with more compassion — and intelligence — than we are at present.

Dana H. Murphy

Comments

The Future of Research into Relationships Between People and Their Animal Companions

Boris M. Levinson, Ph.D.

In sharp contrast to prevalent public attitudes of 20 years ago, the field of animal-human relationships is now respected as a legitimate area of scientific investigation. However, it has not yet evolved into a full-fledged discipline: a specific term for this discipline, a body of theory, and a methodology of its own must still be developed. This methodology should make use of both the intuitive and scientific approaches in order to encompass the full richness of animal-human interaction. Four main areas of investigation would be fruitful at this point: (1) the role of animals in various human cultures and ethnic groups over the centuries; (2) the effect of association with animals on human personality development; (3) human-animal communication; and (4) the therapeutic use of animals in formal psychotherapy, institutional settings, and residential arrangements for handicapped and aged populations.

An ambivalent relationship has existed between humans and animals since ancient days, but we may now be ready to translate into reality the myth of the Golden Age when animals and humans lived at peace with each other.

It was only 20 years ago, at a meeting of the American Psychological Association, that I first presented a paper on the "Dog as a Co-therapist" (Levinson, 1961). The reception was lukewarm. While some accepted the ideas, others met them with ridicule, even inquiring as to whether the dog shared my fees. I became known as the *dog's* co-therapist.

Obviously, much water has flowed under the bridge since then. The problems raised in my original paper and in subsequent articles have come to be taken seriously by society at large. Even the academic world has granted recognition to our field by awarding doctorates in the discipline of animal-human relationships. However, in spite of these promising beginnings and accomplishments, it seems to me that this field has not become a true discipline as yet.

Perhaps there are advantages to this rather ambiguous status, since our attempts to define our field help us to remain spontaneous and flexible in both methodology and subject matter. How, for example, do we account in our research for such factors as the intimate,

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playful, idiosyncratic interrelations between animal companions and their owners? What are we to do with data that arise spontaneously? How can we measure these? Is it possible that our experimental and statistical studies cancel out these most important interchanges?

It seems to me that the relationship between people and their animal companions can encompass almost all areas of human behavior. In order to begin careful studies, the domain of possible investigation has to be delimited and given a focus. We should decide what we are trying to do and in what field we are operating. Is it comparative psychology (Denny, 1980; Dewsbury, 1978), ecological psychology (Bronfbrenner, 1979), environmental psychology (Baum, 1980); Stokols, 1978), ethology (Barnett, 1981; Fox, 1974), sociobiology (Barlow, 1980; Wilson, 1975, 1980) or social psychology (Berkowitz, 1980; Goldstein, 1980)? I believe that our work actually lies in none of these established disciplines, since none of these can encompass all the concerns of our new science. Instead, we will have to look for new insights, new definitions, and new boundaries. Above all, we will have to place research in this field in a historical and comparative perspective. One possible definition of this field might be that it is the science of human/companion-animal/environment interrelationships.

On the one hand, this discipline touches upon problems that might well be investigated by rigorous, scientific experimentation. On the other hand, it involves enquiry where measurement cannot bring answers and intuition must reign — a path of study used by artists, as well as by generations of ordinary people. Both approaches are, in my opinion, equally valid and equally worthwhile. The intuitive method looks at an animal as a teacher and friend, while the scientific method looks at an animal as an object of curiosity.

Intuitive Method

I believe that early humans were aware of a mysterious something that united them to animals and indeed to all living things. People saw the natural world to which they and the animals belonged as the indestructible source of life. Animals were brothers in nature (Jensen, 1963), from whom humans could learn much and through whom they could achieve some measure of acceptance of their own mortality. Our early ancestors regarded animals as rational beings and as partners in life (Giedion, 1962). Even though ferocious, animals were seen as younger companions who, while perhaps not as skilled as humans (although some were certainly more skilled in certain ways), were entitled to similar respect and attention. In other words, animals were first viewed as equals.

Early humans understood that "there is a continuum between animal and man" (Fox, 1974, p. 27) and acted accordingly. There was an understanding of how an animal felt and a corresponding respect for the animal's feelings and drives. Animals were perceived as having intimate thoughts and aspirations, as well as unseen powers and connections with nature that humans did not possess (Tylor, 1958). In this sense animals were viewed as superior — sources of wisdom and strength. Early humans, therefore, began to worship animals as representatives of the natural forces that determined their ultimate destiny. Totem animals, for example, could be invoked to intercede with nature on their worshipper's behalf and thereby provide some protection against death in a very dangerous world.

Primitive humans may have experienced mental images of dead companions (Siegel, 1977) and assumed that these were evil spirits. They therefore had to dispose of the feared dead body (which taunted them in their dreams) in an *honorable* fashion so that it would

not desire to return to do harm. Help was needed to pacify the dead person and send the still-living, unattached, and potentially malevolent spirit happily on its way into the netherworld. Humans may have turned to animals for guidance in this procedure, using a particular animal which, as a god, had supreme powers to serve as a psychopomp or guide to the netherworld. The rituals that were evolved to bring about this neutralization of a potentially evil spirit considerably alleviated early Homo sapiens' anxiety about death (Leach, 1961).

Animals, therefore, have fulfilled one of our deepest human needs — the need to feel safe — and have long served as a symbol of power and nurturance. They have also functioned as an externalization of man's control over his own evil impulses (the "wild" animal with its power to kill is converted into a savior that keeps killer man under control). Such a relationship, with its deep unconscious roots and its elements of empathy and identification, does not lend itself to study solely by objective observation and measurement. There may be an unconscious communication between humans and their animal companions of which neither humans nor possibly their animal companions are aware until a crisis such as death occurs. The intuitive ties between humans and animals require intuitive methods of study, if only to delineate those questions that we might want to try to investigate in more scientific ways.

There are many such questions. For example, How does an animal predict when its master is due to return home? How does it become aware of the death of its master, even though the death may have occurred hundreds of miles away? What is the meaning of an animal's mourning for a lost master? How does an animal know when it is about to die? What is the nature of the mourning that an animal does for another animal? In order to address these questions, we have to learn more about processes like psi trailing, extrasensory perception between humans and animal companions, and animal hypnosis, because these questions presuppose the existence of certain feelings and cognitions on the part of animals (Griffin, 1981). Our certainty that these exist derives from our intuitive knowledge of the animal companions we have lived with, observed, and read about over the ages.

The Scientific Method

The second approach, the scientific one, is a method by which we seek to answer some of the questions suggested to us by our intuitive knowledge. It is a method that seeks to place our knowledge within a logical structure or system to discover the underlying mechanisms of animal-human relations and thereby bring these relations into the domain of natural law, rather than relegating them to the realm of magic, symbolism, and fantasy.

In order to do useful scientific research, we first need an adequate theory to generate questions and methods. Then, the results must be very carefully evaluated. The model we should be seeking should allow both naturalistic observations and controlled field and laboratory work. We need longitudinal, cross-sectional as well as experimental studies. We also need replication of studies. We must also remember that there is an interaction, *i.e.*, a reciprocal relationship between the animal companion and its master and that each causes effects in the other.

While I wish to stress most forcefully the need for vigorous research in our field, no matter how we may define it, I wish to stress with equal vigor that the non-experimental, non-replicable observations made by generations of animal companion owners have contributed immeasurably to the development of our field and indeed may actually have brought it into being.

Scientific research in the field of animal-human relationships, by whatever name we choose to call it, has been very meager to date. However, there have recently been promising beginnings (Bustad, 1980; Corson and O'Leary-Corson, 1980; Fogle, 1981; Katcher and Weir, 1977), although this field remains a stepchild in terms of research interest, financial support, and prestige. There are numerous methodological challenges, challenges that have sometimes been met in very inadequate ways. I have discovered, for example, that a favorite study of investigators into human-animal relationships is the comparison of the personality traits of dog and cat owners with those on non-owners. However, this has been done without specifying in exact terms how such personality traits were to be defined and measured, so that the reliability and validity of the measures used left much to be desired and, consequently, invalidated the subsequent research involving these measures (Allen *et al.*, 1979; Brown *et al.*, 1972; Guttman, 1981; Kidd and Feldman, 1981; Wilbur, 1976).

Similarly, sampling techniques were such that the findings could not be generalized to other populations. Important variables of the animal owners such as age, marital status, education, intelligence, and socioeconomic status, if not specified, prevent us from knowing whether the sample studied is representative of more than a particular group.

The characteristics of the companion animals also have to be specified when comparing animal owners with non-owners. We forget that each human and each companion animal is unique. Are we talking about the owner of a Pekingese or a Great Dane, or of a Siamese or an alley cat? Suppose we do secure statistically significant differences between the two groups (*i.e.*, owners and non-owners). In this instance, we must remember that these are quantitative differences, and we must not forget about the qualitative differences that may concurrently exist. We must also consider the contexts in which the subjects find themselves. Are they comparable? And if not, are our findings of any practical value in the absence of assurance of comparability between samples?

However, in spite of my criticism of the various studies, because of the great diversity of instruments and techniques used and the lack of randomized samples, the mere fact that similar results have appeared in many different studies is significant. This should increase confidence in the field and in the results obtained, since these have been secured despite disparate measures and populations (Allen *et al.*, 1979; Anonymous, 1976; Brickel, 1980, 1981; Corson and O'Leary-Corson, 1975; Kidd and Feldman, 1981; Levinson, 1969; Mugford and M'Comisky, 1975; Wilbur, 1976).

What, then, do I see as fruitful avenues for the researcher in the field of animal companion-human relationships? From the vantage point of a participant observer, I see four distinct areas for possible concentration, although these are by no means all-inclusive in terms of the questions we need to ask. These areas are: (1) the role of animal companions in various human cultures and ethnic groups from earliest recorded history to the present; (2) the effect of association with animal companions on the development of character, emotions, and attitudes in humans; (3) human-animal companion communication; and (4) the therapeutic effects of associating with animal companions.

Obviously all of these research areas are interrelated; if we approach one we cannot help but touch upon the others. If we discover a new facet in one, we cannot help but see other problems in a new light. For the sake of brevity and clarity, however, I will limit myself to looking at each of these rubrics separately and leave it to the synthesizers in the field to elucidate their interrelationships.

The role of animals in human cultures

We are continually being made aware of the mysterious thread that unites all life. W. Horsely Gantt (cited in McGuigan, 1981) found that the approach of a human to an animal increased the animal's "heart and respiration rate," while subsequent contact such as stroking had a tranquilizing effect. Gantt hoped to identify the modality by which this effect was produced, and he sometimes mused that if he systematically eliminated all the known stimulus modalities he might come upon a special kind of energy: "Is the effect of person transmitted by the known senses, or is it transmitted through radiation or some kind of as yet unmeasured waves with unknown laws of transmission?" (p. 417).

Our relationships with the animal kingdom began in the very distant past, millions of years ago. Our attitudes to our neighbor animals have taken millions of years to develop. As humans began to differentiate themselves from the animal kingdom, various elements of these attitudes remained with them to agitate, confuse, and occasionally enlighten. These feelings were eventually crystallized in art, literature, and philosophy.

When we look at the history of human art, we notice that in the beginning the animal seemed all-powerful and the human a mere fleeting shadow, as seen in cave paintings of the leaping bison and galloping horses at Altmira and Lascaux. Later on, humans came to occupy a more important but still subsidiary role, for example, in the art of the Egyptians, where the bodies of the figures were human and the heads were animal. Still later, humans became supreme and the animals subordinate. We can see this in the art of ancient Greece, where the bodies, such as those of the centaurs, were animal while the heads were human (Clark, 1977).

In separating themselves from animals as they developed symbol-using cultures, humans had to repress their longing for, and veneration of nature (which they were destroying) and to exalt human reason above the "animalistic" qualities that humans shared with the rest of the animal kingdom (*e.g.*, such basic drives as hunger and sex). Medieval and Renaissance paintings depicted animals as humans' servants, pets, hunting targets, and status symbols (*e.g.*, the nobleman with his mastiff). In tapestries we see the introduction of a mythical animal, the unicorn, a pure white, long-horned, gentle creature that seems to represent an attempt to ennoble sexuality and relate it to Christian mythology (which had already made use of a white dove to represent the "Holy Spirit," the principle of impregnation without carnal contact).

In the art of the twentieth century, both human and beast are disembodied and reduced to abstractions, thereby totally disconnecting humans from their own animal nature and thus from their link to the rest of the animal kingdom. This most recent phase demonstrates the triumph of the cerebral, and it is probably not a coincidence that modern people feel closer to machines than to living creatures, and ruthlessly slaughter each other and animals.

Literature, too, has reflected changing human views of the animals' place in the scheme of things. The Bible assigned the animals the role of teacher, "But ask the beasts and they shall teach thee and the fowls of the air, and they shall tell thee" (Job 2:7-10). A Talmudic passage states that "if a man had not been taught the laws of propriety, he might have learned them from the animals."

In Greek mythology, Chiron, the centaur who had the legs and body of a horse and the head and brain of a human, ran a school in his cave at Mount Pelion. Chiron was reported to have been an excellent teacher, numbering among his students Achilles, Jason, and Asclepius (Candland, 1980). We know

that many preliterate peoples have learned how to take care of their sick and wounded by learning from the behavior of animals (Siegel, 1973)—for example, snake-bite treatments and the healing properties of mud and clay.

Myths and fairy tales express the basic world-view of a people, often through the behavior ascribed to animals. Ethical values, and the struggle between good and evil forces have frequently depicted in terms of animals, as in the modern literary myth, *Moby Dick* (Melville, 1952). Freud (1964, p. 9) has reminded us that "animals owe a good deal of their importance in myths and fairy tales to the openness with which they display their genitalia and their sexual functions to the inquisitive little human child."

Through a study of the art, religion, and literature (oral and written) of diverse ethnic groups and pastoral, hunting, tribal, or industrialized societies, we could attempt to determine how humans have tried to come to terms with themselves as "reasoning animals" and with what has happened to human social relationships, as well as human stewardship of natural resources, when animals have been elevated or denigrated in relation to humans.

Animals and human personality development

In our rapidly changing technological society, in which the small nuclear family functions as the "school" in which human relations, love, and empathy are taught, companion animals may play a more important role than they did when the extended family provided more companionship and learning experiences, and life, particularly in the rural areas, provided more opportunities for daily contact with the domestic animals that were crucial to the economic existence of the family (Levinson, 1972).

I believe that the personality development of an individual who has an animal companion or is surrounded by animals will be somewhat different from that of an individual who does not have daily contact with them (Levinson, 1978). The ownership of an animal companion may aid in the development of adaptive personality traits. Research should be able to determine whether, other things being equal, adult owners of animal companions show more empathy for fellow human beings than non-owners. What of those who did or did not have animal companions in their childhood? Are owners of animal companions more comfortable in their sex roles than non-owners? Do animal companions play different roles in the personality development of boys as opposed to girls? Is there a different incidence of mental illness—*e.g.*, severe depression and schizophrenia—among animal owners versus non-owners? Do owners who have experienced the death of an animal companion handle human bereavement more effectively than non-owners? Is there any difference in the way owners treat animal companions when they view the latter as either similar to or different from themselves in terms of personality traits?

Animal ownership may contribute to the establishment of a life-style that involves nurturing of and companionship with a living creature that can sustain a conviction of life's value even under difficult circumstances. It would be valuable, for example, to investigate the effect of animal companionship on people with terminal illnesses such as cancer. Is there a difference in survival rates between owners and non-owners of animal companions? What of those with chronic illnesses, such as diabetes, muscular dystrophy, arthritis, and cardiovascular diseases? Does animal companionship significantly reduce the stress of divorce and widowhood and help in the effective management of these situations?

When an animal companion is introduced into a family, the entire

climate of family interaction changes and becomes more complex, thus affecting the development of each individual member and the personality of the family as a unit. Children become "parents" to the animal; the animal becomes a "new child" to the parents. Research topics in this area might include the following: What influence, if any, does the animal companion in a family have on the incidence of divorce, desertion, child and spouse battering, and criminal actions by family members? Does the presence of an animal companion reduce parental stress? How are animals used as child substitutes? Why is the feeding of zoo animals so prevalent? Is this done more by animal owners than non-owners? Do family members do this more or less frequently than those who are single?

Human-animal communication

Humans and animals, as we all know, communicate with each other on an intuitive level. We observe humans talking to or petting their animal companions and the latter reciprocating by an appreciative bark or wagging of the tail. Dogs seem to know when their owners have decided to take them for a walk, running expectantly to the door before they have even stood up. We also know that zoo keepers understand quite a bit of the moods and behavior of the animals in their charge. Books have been written on the communications that horses try to make to their owners (*e.g.,* Ainslee and Ledbetter, 1980).

We know that animals can think (Griffin, 1981), although they may not think the way we do and do not follow human logic. They also use language. Again, the language is not the same as ours, although some chimps and gorillas have been taught to manipulate symbols that stand for words in our own language (Rumbaugh, 1977). Animals can communicate with each other just as we do (Sebeok, 1977), and as far as I can tell, that is what language is all about. Although it is difficult for most of us to accept, the idea that only humans can convey meaningful expressions has finally been destroyed, and we humans can no longer claim that language constitutes the greatest distinction between us and the animal kingdom (Schmeck, 1980).

Yet the idea that we can communicate with animal companions raises ambivalent feelings in most of us: we feel threatened now that our unique position as *primus inter pares* among primates has been challenged by "talking" chimps and gorillas. However, we are also fascinated by the possibility that, like King Solomon, we may be able to communicate with all species. Possibly, part of the fascination the animal companion has for us, its inscrutability (because of the inability to talk), will be lost. However, in beginning to communicate with animals we may be on the threshold of discovering the animal's point of view.

The research into communication between animal and human can be broken down into two overlapping categories: (1) verbal and (2) non-verbal.

As I see it, the important research areas for us to engage in are those that are related to nonverbal communication. Here I am adopting and somewhat expanding the scheme of Harper, *et al.* (1978, p. vii). Within these areas I would include (1) paralanguage and the temporal characteristics of speech, (2) facial expressions, (3) the kinesic behavior of body movements, (4) visual behavior, (5) proxemics, or the use of space and distance, (6) touch behavior, and (7) chemical sensitivity. We must also include empathy as a form of communication between animal and human, that is, the capacity of a person (or animal) to experience the needs and feelings of others as if they were his or her own. While, for the sake of study, we may segregate these elements into separate categories, we must remember that actual commu-

nication takes place simultaneously via many channels (Bowlby, 1980; Harlow, 1974; Katcher and Weir, 1977; Montagu, 1978).

The attempts to date to communicate with animal companions have been faulty. They have been limited to certain verbal instructions to our animal companions for the purpose of obedience training or skilled "acting" careers in the circus, TV, or movies. We suspect that dolphins and whales can communicate with each other through clicks and whistles, appearing to some human observers to be expressing in this way such feelings as anger, joy, or annoyance (Busnel and Fish, 1980; Lilly, 1978). However, we have failed to address ourselves to the meanings, *i.e.,* the adaptive functions, of the languages of our animal companions. We have tried to teach an animal companion *our* language, our way of communicating, rather than trying to learn his (Terrace, 1979). Also, the bodily states of emotion in animals should be carefully studied to provide clues to the best ways of communicating with animals (Peters, 1980).

We should also become aware of the fact that, in becoming domesticated, the animal companion loses some of its ability to engage in nonverbal communication with its own kind (Scott, 1980). This happens because a domesticated animal no longer needs to forage for itself or to communicate to a co-specific the location of food or the presence of danger.

Animal companions as co-therapists

When we use animal companions as co-therapists in our attempt to help people resolve emotional problems, we provide individuals with an opportunity to experience a variety of feelings that they may not have previously recognized in themselves. The animal permits the person to see himself or herself as small or big, as father, mother, or child, depending upon his or her specific needs at a particular point in his or her psychological development.

Perhaps this use of animal companions can help us solve the riddle of the way in which all types of therapy work. Many researchers talk about a common element, *i.e.,* the therapeutic factor, in various modes of therapy. Perhaps working with animals as co-therapists will help us isolate this common element. Perhaps animal co-therapists supply the mysterious something that is common to all effective therapies. I first mentioned this idea in an article in 1965 (Levinson, 1965, p. 698) when I asked: "Do we possibly have in pet therapy a tool which permits us to examine at great length and under magnification the elusive something which promotes emotional healing?"

In discussing animal companions as co-therapists, we must consider the radical change that has occurred in the way we construe therapeutic services in the last 20 years. We are abandoning the older medical model; we no longer think of a person who comes to us for help as a "patient," but rather as an individual like ourselves who has problems, as well as certain strengths and weaknesses.

When we use animals as co-therapists, patients or clients need not feel that they are mentally ill. Instead, they can consider themselves as showing some type of social maladjustment or incompetence, and we can help them recognize that they can do quite a bit to help themselves. The model of learned helplessness need not apply after all (Abramson *et al.,* 1978).

We no longer think that one must be a professional psychotherapist to be able to help. Anyone can help. We now emphasize that paraprofessionals, peer groups, and self-help groups all have much to contribute. The use of animal companions also encourages mutual social support and thereby induces quicker social and emotional adjustment. We can therefore see how the pet therapy

movement fits in well with this current trend.

The use of an animal companion as a friend is very helpful to a person who is trying to establish competency in coping with his or her life. Relating to an animal in no way denigrates clients or makes them feel helpless or dependent, as they might if all their attention were focused on a human therapist. Instead, they find their own source of good health within themselves, in the course of their evolving association with the animal companion. One factor that I believe has completely escaped research investigation so far is the fact that the individual who is treated with the help of an animal co-therapist may develop an entirely different concept of self than the one who is treated without one.

Increased independence can also be the goal of using animal companions to assist those who have spent much time in congregate living quarters — such as institutions, nursing homes, prisons — and are trying to learn to live on their own. These might include aged, partly sighted, deaf, alcoholic, physically handicapped and mentally retarded clients.

Animals can be taught to act as "trained" nurses by learning to react to any unusual behavior on the part of their charges, such as a change in the rhythm of breathing, unusual perspiration, heart palpitation or excessive fever. With chronically ill bed-ridden patients, they can act as 24-hour nurses' aides.

Animal companions can also facilitate the independence of institution-bound people, by providing them with a living creature as a focus for concern and care; in addition, they can draw upon the animal's strength and intelligence and thereby compensate for their own deficits.

Possible Areas for Future Investigation

There are an almost limitless number of research topics related to companion animals, whether in formal psychotherapy or as a therapeutic element in the daily environment.

The first broad area for investigation involves amassing data about the animals themselves. We must establish criteria for the selection and breeding of animals that are suitable for work with children, the aged, the retarded, and the physically and emotionally handicapped. Animals used as co-therapists in an office setting may have to have different characteristics from those used in prisons, nursing homes, hospices for the dying or schools for the mentally retarded. We might experiment with the use of a wide variety of animals, exploring the best kinds of contributions that each might make to therapeutic work.

Another area for investigation involves the human therapist-animal co-therapist relationship. What, for example, are the differences in personality between those therapists who can effectively use animals and those who cannot or do not wish to? How does the use of an animal affect the therapist's attitude toward his or her patient? How does a patient's relationship with the animal affect the therapist's self-image and sense of competence? Is the animal viewed as a rival by the human therapist?

Animal companions have proven particularly useful in psychotherapy with children. Here, there are many questions that have come to light. For example: What problems best lend themselves to resolution through the aid of a companion animal in play therapy? How do the personalities of child, therapist, and animal interact? How does the animal help the child achieve insight or increased maturity? How can the presence of a companion animal at home augment or even substitute for the activity of a therapist? How does the child identify with the animal? How does the therapist make use of the child's nonverbal behavior with the animal? What is the dif-

ference between children who can and cannot use animals in their treatment? Is the relationship between the animal and the child similar to the one between the animal and the therapist? What limits should be set on the child in relation to the animal, and how does this affect the treatment? When is the use of an animal co-therapist inadvisable?

Finally, we may explore the fundamental nature of therapy itself, especially in the instance of those therapists who decide to use animals with some patients and not with others. Which elements that the animal introduces into the situation are therapeutic and, in some cases, which are not? What kinds of impressions is a therapist who uses an animal co-therapist conveying to his or her patients by this action? Do animals make more of a contribution at some stages of therapy than at others? Are there phases of therapy during which the presence of an animal would actually detract from the therapeutic work?

There are many other interesting research problems. For instance, How does companion animal therapy compare with other current therapies in terms of the development and strengthening of the patient's ego? Does the use of an animal promote better integration and more autonomy? Do transference and countertransference differ in companion animal-treated cases as opposed to those cases that are treated by more conventional psychotherapeutic approaches? Research is also needed to discover what kind of animal companion would be most helpful to people with specific types of problems.

Conclusion

I would like to suggest that this new science take a close look at the relationships that are currently developing between humans and animals. Some of us no longer look upon animals as either domestic or savage, or noble or base but rather, choose to consider them as our partners on earth. Most of us are aware that our humanity depends in part on how we relate to animals and to nature as a whole. Most of us also are aware that an ambivalent relationship — really an undeclared war — has existed between human and animal since ancient days. At first, we saw animals as gods, then as slaves, and then as workers; now we are finally beginning to look at them as companions. Yet we have always dreamed of the mythical Golden Age when animals and humans lived at peace with each other.

Like all myths, this one described an idyllic world that never existed but that expressed the deep longing within human beings to be at peace with others and with themselves. Now, I believe that we are finally moving closer to the vision of the Golden Age. With the gradual disappearance of wild animal life, peaceful coexistence betwen humans and animals is becoming a reality in zoos and in protected wildlife sanctuaries. It is now our task to work toward fulfilling the vision of the Prophet Isaiah that "the wolf shall dwell with the lamb, and the leopard shall lie down with the kid" (Isaiah 11:6).

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The Changing Concept of Animals as Property

Vincent P. McCarthy

Introduction

In a suit brought by a slaveowner against his neighbor in 1827 for the killing of his slave, the court found that the bad character of the slave (caught while stealing potatoes from the defendant's property) should be taken into account by the jury in assessing damages for the wrongful destruction of the slaveowner's property (1). However, the court warned:

> *But where property is in question, the value of the article, as nearly as it can be ascertained, furnishes a rule from which they [the jury] are not at liberty to depart* (2).

Almost 100 years later, another litigant brought suit in Connecticut to recover compensation for the wrongful destruction (3) of his personal property, which was shot while similarly trespassing on a neighbor's property. This time the plaintiff's personal property was his dog. In reaching its conclusion that the plaintiff was entitled to recover for the loss of his dog, the court reaffirmed the well-established common law property status of animals:

> *It [the statute] attaches to the right of property, including a recovery of damages under circumstances where such a recovery would be allowed for other kinds of personal property* (4).

That slaves were viewed as nothing more than the personal property of their owners had never been seriously questioned. One of the earliest treatises on British law makes note of this status, and it adds an interesting comment on animal rights. In distinguishing serfs, who did have recognized legal rights, from slaves, Maitland notes:

> *In relation to his lord the general rule makes him rightless...the state is concerned to see (only) that no one shall make an ill use of his property. Our modern statutes which prohibit cruelty do not give rights to dogs and horses...* (5).

The most well-known legal statement on the personal property status of American black slaves makes it clear that this view was never seriously questioned.

> *They had for more than a century before been regarded as beings of an inferior order, and altogether unfit to associate with the white race, either in social or political relations; and so far inferior, that they had no rights which the white man was bound to respect; and that the negro might justly and lawfully be reduced to slavery for his benefit...This opinion was at that time fixed and universal in the civilized portion of the white race. It was regarded as an axiom in morals as well as in politics, which no one thought of disputing, or supposed to be open to dispute; and men in every grade and position in society daily and habitually acted upon it in their private pursuits, as well as in matters of public concern, without doubting for a moment the correctness of this opinion* (6).

Enforced and maintained by a legal superstructure that regulated every aspect of a black's social, political, economic, and religious life, his property status continued until the middle of the nineteenth century when Congress passed the 13th, 14th, and 15th Amendments to the Constitution, which overturned the

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Dred Scott decision and recognized that a black human being had legally protectible rights.

There are some signs in recent legal decisions that a similar evolution in the status of animals is taking place: judges are beginning to draw distinctions between animals and property.

But can we ever expect that the courts will grant full liberation to animals from their status as property? Blacks, although universally considered inferior to whites, were always considered to be members of the same species as whites. Does this taxonomic distinction between animals and man doom efforts to enhance their legal status? Although most states still view animals as the personal property of their owners (7), recent cases have begun to question this doctrine by rejecting its jurisprudential basis in the context of mounting scientific, sociological, and philosophical evidence to the contrary. More important, these decisions have in common a profound sense of disbelief in the present status of animals as property, based on an experience of animals that does not fit with their status as objects no more valuable than furniture or a television. It is at this most basic level of law as a formalized reflection of experience that the legal rights of animals have begun to grow and take shape.

Sentimental Value

In 1975, a suit (*Stettner* vs. *Graubard*) was brought in a New York lower court to recover the $220 cost of veterinary services required for injuries to a dog (8). In opposition to this claim, the defendant argued:

1. That damages cannot exceed the market value of dog regardless of how high the veterinary bills run; and
2. That a dog's market value is its purchase price minus depreciation.

In short, the measure of damages for the death or injury to a dog was asserted to be the same as might be applied in the case of an automobile or any other item of personal property (9).

After noting that the purchase price is only one factor to be considered in ascertaining the market value of a dog, the court listed "other relevant factors" including the dog's age, health, usefulness, and any special traits or characteristics of value. But the court also held that

> *Sentiment, however, may not be considered since that often is as much a measure of the owner's heart as it is of the dog's worth* (10).

Although the actual purchase price of the dog had been $125 to $150, the court found that the dog had a market value of $200. The rejection of sentimental value as a measure of recovery is consistent with the majority view, although many courts have sharply limited their definition of sentimental value in other personal property cases (11). The problem in the issue of sentiment is really an evidentiary one (12); sentimental value can be approached more practically when considered under the rubric of theories such as companionship, loss of use, or mental anguish.

Much of what was lost in *Stettner* has been regained in two more recent New York lower-court decisions. On July 10, 1980 the *New York Law Journal* published a small-claims opinion that expanded the measure of recovery for the death of an animal to include a pecuniary award for loss of companionship (13). The plaintiff, Mrs. Brousseau, delivered her healthy 8-year-old dog for boarding at Dr. Rosenthal's kennel. When she returned to the kennel she learned that her dog had died. In her suit, which charged negligence, the court awarded her $550, plus costs for her loss.

Despite the fact that the compensable loss was suffered by the owner and

not by the dog, *Brousseau* significantly enhances the basic concept of an animal's value. As another New York lower court stated recently:

> *This court now overrules prior precedent and holds that a pet is not just a thing but occupies a special place somewhere in between a person and a piece of personal property.*
>
> *In ruling that a pet such as a dog is not just a thing I believe the plaintiff is entitled to damages beyond the market value of the dog. A pet is not an inanimate thing that just receives affection; it also returns it* (14).

Animals, or at least those animals that we call pets, are to be viewed in legal contexts as more than property, not just because of their special value to their owners but more importantly because, intrinsically, they are considered as being more valuable than mere property. Other kinds of personal property may be important and valuable to their owners, but animals respond — they are alive.

> *An heirloom while it might be the source of good feelings is merely an inanimate object and is not capable of returning love and affection; it has no brain capable of displaying emotion which in turn causes a human response. Losing the right to memoralize a pet rock, or a pet tree or losing a family picture album is not actionable. But a dog; that is something else...*(15).

Punitive Damages

Punitive damages are awarded to a party who has established that his loss was caused by a willful or malicious act or an act of reckless indifference to the rights of others (16). Such damages are normally recoverable for the willful or wanton killing of an animal (17), and it is not essential to gaining a recovery for punitive damages that the owner of the animal establish any special value for it. It is the nature of the *act* that provides the grounds for awarding the measure of relief, although the compensatory or punitive nature of the relief may differ among jurisdictions (18).

Recently, larger awards for punitive damages reflect an increased awareness of the value of animals. In one case the court affirmed a jury verdict for punitive damages against a policeman who maliciously killed the plaintiff's cat (19). In another decision (*La Porte* vs. *Assoc. Independents, Inc.*), the Supreme Court of Florida affirmed a punitive award of $1,000 for the malicious killing of a pet dog by a garbage collector (20).

Mental and Emotional Distress

In the *La Porte* decision referred to above, the court was called upon to decide whether damages for mental and emotional distress should be permitted in a suit for the killing of an animal. The plaintiff saw a garbage collector kill her dog by hurling an empty garbage can at him, and a physician testified that a preexisting nervous condition of the plaintiff was exacerbated by the incident. After noting, with deference to tradition, that it was improper to allow recovery for the sentimental value of the dog, the court concluded:

> *The restriction of the loss of a pet to its intrinsic value in circumstances such as the one before us is a principle we cannot accept. Without indulging in a discussion of the affinity between "sentimental value" and "mental suffering," we feel that the affection of a master for his dog is a very real thing and that the malicious destruction of the pet provides an element of damage for which the owner should recover, irrespective of the value of the animal be-*

cause of its special training such as a Seeing Eye dog or sheep dog (21).

Similarly in Texas, a court recently upheld an award of $200 for mental pain and suffering when an owner's dog was wrongfully shot by a policeman on the property of the owner (22). The dog had been raised by the owner since he had been purchased at the age of 11 days.

These two cases represent a significant departure from the traditional forms of recovery for "property" loss. An individual is not permitted damages for mental and emotional distress for the destruction of her car or her furniture. Property, by its very nature, is assumed not to evoke this kind of emotional response. It does not have life and therefore cannot respond, and cannot provide friendship or companionship. The focus of the harm in all of these cases is admittedly some human who has suffered a loss, but it is the changing way in which we view animals that has altered the definition of that loss. So the courts are being forced to address the legal status of animals as a prerequisite to granting relief to human claimants.

Guardianship

But what about the question of harm to animals themselves? Can an animal gain recovery for injury sustained through a wrongful act? What about the practical problems involved in bringing a suit and distributing recovery? Not members of our species, animals would need a representative through which their claims could be presented. Such an approach was suggested by Justice Douglas of the United States Supreme Court when he urged that standing be granted to governmental or public interest groups to litigate on behalf of

> *The pileated woodpecker as well as the coyote and bear, the lemmings as well as the trout in the streams* (24).

A similar "guardianship" model already permits suits to be brought on behalf of ships and corporations (25). The interests of fetuses are considered in granting the right to abortion (26), and the right of parents to sue for prenatal injuries (27). Are fetuses or corporations more deserving of legal recognition and protection than animals? On what grounds? That the fetus may suffer? That the corporation may be deprived of some economic interest without due process? Do we explain the differences in protection by noting the *human* ownership of corporations and the fetus's potential for *human* life?

To do so would be to beg the question of the bases on which we assign the ownership of such rights. Why do we limit legal interests to humans or human creations? Henry Salt, Peter Singer, and others have argued persuasively that the biological, behavioral, and cognitive differences between the human and other animal species are hollow justifications for the continued failure to recognize the interests of animals.

Conclusion

Although the cases discussed above mark a significant departure from the traditional common law approach toward animals, the focus of harm and protectible interest remains with the human who is asserting ownership of the animal. It is the owner who is considered to have suffered some loss through the invasion of a *legally* cognizable interest, and it is the owner who receives compensation for his or her loss. In order to fully liberate animals from their status as personal property, courts must begin to look for interests which are inherent to the animals themselves that have been invaded, and then fashion some legal protection for those interests.

However, I am confident that courts will continue to expand the domain of animal rights through the "owners' rights

bootstrap" approach. As the owners of animals assert more aggressively their rights to the friendship, companionship, and assistance of animals, courts and legislatures will become more sensitive to the importance and value of animals. And, while this article has focused principally on companion animals, with a few exceptions it can be argued that changes in the rights of companion animals will effect corresponding changes for all animals.

When this process has reached the point at which the interdependence of human and animal becomes clear, the law will begin to focus on the specific interests of animals themselves, considered separately from their value as subordinates. An animal will then be seen as an autonomous being, with interests that are worthy of consideration equal to those of human beings; these will not be the same interests, but rather, different ones that are similarly deserving.

This change will take place as a consequence of efforts to enlarge the sphere of human interests assigned to the owners of animals and to thereby increase the pecuniary rewards for the successful assertion of these interests. In order to address this issue, the law will have to focus on precisely what the human has lost. A thorough investigation and evaluation of this loss will result in better understanding of the sentient, cognitive, and biological relationships between human and animal (28). Inevitably, some owner or animal group will eventually introduce a breakthrough case, on behalf of an animal, in which a court will award damages for the loss to the animal himself. These damages will be awarded as compensation for losses relative to interests that will have become legally recognized as established interests of animals, according to the precedents set by the "bootstrap" analysis (29). Some of these interests are already in the process of being defined; for example, the rights to life and humane treatment, which were established in the cases described above. Other interests will probably be defined soon — these include adequate food and shelter and some standard for freedom of movement.

Ironically, this process in the legal sphere will find its culmination when human and animal recognize what has always been true: that they are mutually dependent on each other for survival, meaning, and happiness, on an unknown, and mysterious planet.

References

1. *Richardson* vs. *Dukes,* 7 S.C.L. (4 McCord) 156 (So. Ca. 1827).
2. *Id.* at 157.
3. Pollock & Maitland, *The History of English Law* 599 (2nd ed. 1898).
4. *Scott* vs. *Sanford,* 60 U.S. (19 How.) 393, 407 (1857).
5. Note that personal property is destroyed and not killed. Killing implies the status of life, which is at odds with the status of personal property as an object and possession.
6. *Sonny* vs. *Wysocki,* 139 Conn. 622, 96 A.2d 225, 228 (1953).
7. *See also,* Conn. G.S. §22-350, (Dogs as personal property): Cal. Rev. Code §491 (Dogs are personal property, and their value is to be ascertained in the same manner as the value of other property); *Sentell* vs. *New Orleans Railroad Co.,* 166 U.S. 698 (1897).
8. *Stettner* vs. *Graubard,* 82 Misc.2d 132, 368 N.Y.S.2d 683 (Harrison Town Ct., Westchester Co. 1975).
9. *Id.* at 132.
10. *Id.*
11. *Mieske* vs. *Bartell Drug Co.,* 92 Wash.2d 40, 593 P.2d.1308 (1979) The Washington Supreme Court decided to allow recovery for the intrinsic value of 32 50-ft reels of developed film that were lost or destroyed by a processor, the court based its hold-

ing on the fact that the owner would be unable to replace the lost film on the market. In *Wertman* vs. *Tippling,* 166 So2d. (Fla. Dist. Ct. App. 1964), the court permitted a $1,000 recovery for the peculiar value of a dog to his owner. The court distinguished recovery here from recovery for sentimental value, which the court defined as being "affectedly or mawkishly emotional."

12. On the distinction between proof of damage and difficulty in proving the extent of damage, *See, Brousseau* vs. *Rosenthal,* N.Y.L.J. 11 (July 10, 1980).
13. *Id.*
14. *Corso* vs. *Crawford Dog & Cat Hospital, Inc.,* 97 Misc. 2d 530 (1979).
15. *Id.*
16. *Collens* vs. *New Canaan Water Co.,* 155 Conn. 477, 234 A.2d 825.
17. 1 ALR 3d. 1022 (Dogs); 4 Am. Jur. 2d. *Animals* §147; 3 C.J.S. *Animals* §234.
18. For Connecticut's "compensatory" rule, *See, Lomas and Nettleton Co.* vs. *Wterbury,* 122 Conn. 228, 188 A. 433 (1936).
19. *Wilson* vs. *Eagan,* 297 N.W.2d 146 (Minn. 1980).
20. *LaPorte* vs. *Assoc. Independents, Inc.,* 163 So.2d 267 (Fla. 1964).
21. *Id.* at 269. *See also, Banasczek* vs. *Kowalski,* 10 D.&C.3d 94 (Luzerne Co. 1979).
22. *City of Garland* vs. *White,* 368 S.W.2d 12 (Tex. Civ. App. Eastland 1963).
23. The cases still refer to an animal with an objective pronoun, while most pet owners I know refer to the gender and names of their pets. One rarely names his or her chair, rug, painting or television set.
24. *Sierra Club* vs. *Morton,* 405 U.S. 727, (1971) (dissenting opinion).
25. Tischler, *Rights for Non-Human Animals: A Guardianship Model for Dogs and Cats,* 14 *San Diego L. Rev.* 484 (1977). *See also,* Burr, *Toward Legal Rights for Animals, Environmental Affairs* 205.
26. *Roe* vs. *Wade,* 410 U.S. 113 (1973).
27. *Presley* vs. *Newport Hospital,* 365 A.2d 748 (Rhode Island 1976).
28. Salt, *Animal Rights* (1980).
29. An analysis of the relationship between animals and the elderly has already led to some important legal developments. Other statutes and cases based on these statutes deal more directly with animal loss but are not the subject of this paper, such as state anti-cruelty statutes and humane slaughter laws, as well as the federal Animal Welfare Act, 15 U.S.C. §2131, *et seq.*

The Economics of Farm Animal Welfare

A.J.F. Webster

The number of ways that one can be nice or nasty to animals are legion. This article will consider only one very specific aspect of farm animal welfare, namely, those systems of intensive animal production in which the system itself, irrespective of the quality of the stockmanship within the system, appears to restrict the normal behavior of farm animals to an unacceptable degree. The systems that were considered by the House of Commons Select Committee on Agriculure (1981) include egg production from hens in battery cages, production of veal from calves deprived of solid food and isolated in wooden crates, and the most intensive aspects of pig production, namely, cages for weaners and stalls, with or without tethers, for dry sows.

In their most extreme form, the battery cage, the veal calf crate, and the dry sow stall represent the absolute limits to intensification, since the floor space allocated to each animal is, in effect, no greater than — and sometimes less than — the floor space occupied by the animal when it adopts a normal resting position. Table 1 illustrates examples of floor space allocations for hens, pigs, and calves in commercial intensive units and compares some of these with the recommendations in the revised drafts of the Welfare Codes.

The Farm Animal Welfare Council has been criticized for recommending space allowances in excess of those currently being used in commerce, without providing substantial scientific evidence to show that the welfare of laying hens would be significantly improved by increasing floor space per bird from, say, 400 to 650 sq cm. The advocates of intensive systems contrast this lack of scientific evidence in favor of increased space allowances with the benefits that have accrued from intensification, not only in terms of animal production, but also in terms of animal health. For example, it is much easier to control respiratory disease and parasitism in laying birds kept in cages than in those housed on deep litter.

It is, however, impossible to argue that the policy of space restriction summarized in Table 1 arose out of any positive concern for animal welfare. In order to generate as much gross income as possible and, more important, to stay competitive, producers have simply jammed animals in as tightly as possible. If these intensive producers are moved by compassion for their animals, it has not affected their actions in this regard. In the U.K. at least, there are no limits imposed on a farmer's right to crowd his animals to the absolute limit, and while this situation persists the intensive farmer has little option but to do just that, if he wishes to retain his competitive position in the market.

Space Restriction and Stress

As indicated above, there is little clear evidence to show that extreme space restriction affects the performance of farm animals or induces disturbed behavior. This is not altogether surprising, since it is difficult to construct ethological experiments designed to reveal disturbed

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TABLE 1 Floor Space Available to Some Farm Animals

	Welfare Codes (draft revisions)	Commercial Practice
Battery hens:		
brown birds	450-625	ca 400 cm^2
white birds	370-500	ca 360 cm^2
Pigs: growers (80 kg)	0.45 m^2	0.45 m^2
Veal calves in crates (crate width)	None	60-70 cm

behavior in environments so constricting that almost all forms of behavior are suppressed. Claire Saville and I have, however, some evidence to show that when veal calves grow to a size and age such that a 70-cm-wide crate is extremely restricting, they do show marked departures from the normal development of behavior with age seen in conventionally reared calves, as well as in calves still small enough to move around in their crates. Table 2 shows that as veal calves in crates grew from 2-14 weeks of age, there was a marked increase in the amount of time they spent in purposeless oral activity, tongue rolling, and licking and chewing the walls of their cage. There was also a marked increase in the fearfulness of their response to a set series of actions performed by an observer in the room with them. Both of these kinds of phenomena can, we think, genuinely be called disturbed behavior. Moreover, the large veal calf cannot adopt a normal lying position in a 70-cm-wide crate, and we have evidence to suggest that this disrupts normal sleeping patterns.

Alternative Husbandry Systems

The ideal solution to the welfare problem of intensification would be the development of alternative, acceptable husbandry systems that could compete economically with the most intensive forms of livestock production. However, given the current absence of any legal constraints on intensification, it is most unlikely that such alternative systems will have a significant effect on the status quo.

Table 3 summarizes (and slightly paraphrases) evidence presented to the House of Commons Select Committee on Agriculture concerning the likely costs of egg production in different systems. The cost of producing "free-range" eggs is about 45 percent higher than that for hens in battery cages at current stocking densities. The "straw yard" system, which is a more realistic

TABLE 2 Effects of Rearing Systems on the Development of Certain Activities in Calves

	Suckler calves		Early weaned calves		Straw yard veal		Crated veal	
Age (weeks)	2	14	2	14	2	14	2	14
Eating and ruminating	6.8	23	26	59	14	15	0.0	0.8
Grooming	3.8	6.9	4.8	5.1	4.4	6.7	12	13
"Purposeless" oral activity	7.0	0.1	4.7	2.4	1.2	3.8	14	24
Induced behavior[1] (overall score)	−54	−42	−12	−35	−24	−14	−48	−86

[1]From A.J.F. Webster and Claire Saville, "Rearing of veal calves," UFAW symposium: "Alternatives to intensive husbandry," 1981. (The more negative the score the more fearful the overall response.)

TABLE 3 Economics of Alternative Forms of Egg Production (Brown Egg Hybrids)

	Caged birds		Straw yards	Free range
	400 cm²	600 cm² min.		
Egg yield: bird^{-1} year^{-1}	260	260	250	240
Production costs (£. bird^{-1} year^{-1})				
Feed	5.50	5.80	5.64	6.00
Labor	0.42	0.64	1.05	2.10
Other	3.17	3.93	3.82	4.08
Capital costs	5.00	8.33	7.00	8.00
Price no. doz. to achieve				
A. Profit of 50p. bird^{-1}	44.3p	52.4	52.8	63.4
B. 10% return on fixed capital	44.3p	54.1	53.8	64.9
C. Relative to cage; 400 cm²	1.0	1.18	1.19	1.43

Data taken from submissions to House of Commons Select Committee on Agriculture by National Farmers' Union and by Dr. T.R. Morris, *Animal Welfare in Poultry, Pig and Veal Calf Production*, vol. II, Minutes of Evidence, p. 221, p. 396-397, London, HMSO.

TABLE 4 Production and Costs of Production of Veal from Calves in Crates and Straw Yards (Data From University of Bristol)

	Crated veal Friesian bulls	"Straw yard" veal Friesian bulls	Hereford x Friesian heifers
Daily liveweight gain (kg)	1.34	1.29	1.17
Carcass weight (kg)	119	98	90
Food conversion ratio	1.56	1.69	1.66
Typical costs (£/head)			
Feed	135	115	107
Calf	60	60	45
Other (excl. labor)	3.50	5.50	5.50
Selling price per calf	235	194	178
Gross profit	+36.50	13.50	20.50

alternative, appears to be about 20 percent more expensive than conventional battery systems. If, however, the space allowance for battery hens was increased to 600 sq cm, this difference would disappear.

The costs of housing and feeding dry sows in kennels and yards is about 25 percent higher than that of tethering them on concrete. Even the much-heralded straw yard system for veal calves has, in our hands, generated £16 to £23 less gross profit per quality calf sold than that achieved by us for calves in crates (Table 4). The capital cost for a straw yard system is undoubtedly lower than that for a crate system but, at present, the straw yard system is not sufficiently advanced to persuade those who have already invested in crates to change.

There are obvious exceptions to these rules. The pig farmer in an area of low rainfall and well-drained soil can run sows very economically out of doors. A few chicken farmers make a good living by producing and selling free-range eggs for the upper middle class health food market. These exceptions are, however, unlikely to be of much concern to the majority of consumers or to the majority of intensively reared farm animals.

Part of the reason why semi-intensive

systems like straw yards for hens or veal calves are less profitable than their highly intensive alternatives must be that practically all research and development in agriculture has been directed toward the most intensive systems. One of the greatest contributions that science can to animal welfare is to explore more fully the nutritional, physiological, and veterinary implications of rearing systems that are deemed *a priori* to be acceptable to a concerned public for reasons that are sound but outside the domain of science. Such research and development could not fail to reduce the economic margin between current scientifically based, highly intensive systems and current cottage-type semi-intensive systems.

Our work with veal calves at the University of Bristol is directed specifically toward this end. The specific problems are technical, relating, *e.g.*, to iron requirements, behavior patterns, or the development of the microbial flora of the gut. The overall objectives, however, are humanitarian.

Constraints on Intensification

In the U.K. there are at present no legal constraints on stocking intensity. The Commission of the European Committees is seriously considering imposing such constraints, for example, imposing by law a minimum floor space of 650 sq cm per bird. A number such as this is, of course, quite arbitrary and thus rather vulnerable to attack. If animals in intensive units were permitted the "five freedoms," as originally suggested by Brambell (freedom of movement to be able, without difficulty, to turn round, groom itself, get up, lie down and stretch its limbs), then layers in battery cages and veal calves in crates would require two to three times the amount of space they get now. Such legislation would, of course, completely destroy the conventional highly capital-intensive systems like battery cages and veal crates.

I do not include myself among those who applaud such legislation, since it would inevitably let in more devils than it would cast out. Cages and pens are, on the whole, quite healthy arrangements and the producer directed principally by profit and minimally by welfare considerations who has been forced by law and economics to get rid of his cages might be induced to rear his animals in a communal squalor that would be much more injurious to their welfare than present conditions.

Most of the recommendations that have come from informed bodies — such as the House of Commons Select Committee on Agriculture — have been more modest than this. I list below a series of recommendations of which I heartily approve and which I can, to a greater or lesser extent, support on the basis of veterinary science rather than emotional anthropomorphism.

1. Dry sows should be provided with a bedded area, which need not necessarily be straw, to improve comfort, reduce feed costs, and reduce the currently unacceptable level of injury.

2. No calf should be deprived of access to solid food, and veal calves reared to a slaughter weight of about 200 kg should be accommodated in crates no less than 80 cm wide. Provision of solid food normalizes oral behavior and the development of the digestive tract; it almost certainly reduces the incidence of enteric disease. Crates of 80-cm width do not allow calves to lie on their side nor, when they are near slaughter weight, to turn round, but they do permit normal grooming, reasonable movement, and a comfortable sleeping position.

3. The floor space available to brown birds in battery cages should be not less than 650 sq cm. This allotment does not allow the bird freedom to stretch its limbs but it does (just barely)

give it sufficient room to reach feed and water points without having to compete too severely with other birds in the cage.

The economic effects of such legislation would be twofold. First, it would increase costs in these intensive systems by about 20 percent, *i.e.*, to the point where they would become almost exactly competitive with the best of the semi-intensive systems. Second, such legislation would, in the short term, restrict output. Assuming, for example, that a space allowance of 650 sq cm for laying birds was enforced throughout the EEC (a necessary precondition for a workable system), then output from existing intensive units would fall by about 25 percent.

The crude workings of the free market are such that the consequences of this shortfall are quite predictable. At first the price of eggs to the consumer would rise by more than the 20 percent necessary to cover the increased production costs, because the producers would gain a sellers' market. In short, profits to the producer would be higher than at present. This would inevitably attract an expansion of poultry units, until such time as supply and demand were back in a reasonable balance. The particular attraction of this situation, from a welfare point of view, is that this incentive to expansion would come at a time when the rules under which farmers operate had just been changed slightly, so that the best of the alternative semi-intensive systems would become economically competitive with conventional intensive systems. The incentive to farmers to develop semi-intensive systems would undoubtedly be reinforced by the fact that, in a time of high interest rates, these systems tend to be less costly in terms of capital investment.

Once production had re-equilibrated according to the new set of rules, the increase in cost should stabilize at about 20 percent (in real terms), and this increase would undoubtedly be passed on to the consumer. However, relative to recent increases in costs of petrol and alcohol, such an increase would be trivial. There has been little, if any, organized consumer resistance to increases in food costs that are seen as necessary to achieve real improvement in animal welfare. The objections have come almost exclusively from the farming industry, in particular through its mouthpiece, The National Farmers Union. Their defense of intensification invariably equates profitability with productivity. When consumer demand is static, as it is in the EEC, then increasing productivity by one group can only be gained at the expense of someone else. Overall, increasing productivity occurs at the expense of the animals, since decreasing gross profit margin per head inevitably reduces the amount of resources that the farmer can devote to the care and maintenance of each individual.

Table 5 compares biological measures of productivity and an economic assessment of the returns per livestock unit for a variety of meat production systems. It shows a clear inverse relationship between productivity and profitability per livestock unit. When time, one of the real benefits of intensification, is taken into account, all systems generate about the same gross profit per annum. In short, the rules of climate, geography, and the marketplace have, to date, ensured that the hardworking farmer gets roughly a living wage, irrespective of the degree of intensification that has occurred in the particular type of livestock production that he practices. Therefore, a slight change in the rules, such that the intensive and semi-intensive systems would become competitive would disturb the market balance for a while — to the detriment of the housewife, but not of the farmer. After re-equilibration, things would remain

much as they are now.

Though the collective voice of agriculture may be vehemently opposed to any constraints on intensification, I know of many individual farmers who would welcome modest legislation of the type that I have suggested. Many have said to me that they are seriously concerned by the lengths to which they have to go to keep up in the race for intensification, a race for which there are no rules. Such farmers would welcome the opportunity, created by law fairly enforced throughout the EEC, to use their personal initiative, not to escape into the past, but to develop good, semi-intensive systems that enabled them to realize greater job satisfaction without bankrupting themselves in the process.

TABLE 5 Average Liveweight Gains and Gross Profit Margins (1975-78) for Different Species and Systems of Meat Production All Expressed Per Standard Unit of Animal Size (S, $kg^{0.75}$)

Species/system	Size (S) at slaughter ($kg^{0.75}$)	Liveweight gain $g.d^{-1}.S^{-1}$	Gross profit margin £.S^{-1}	£.$S^{-1}.year^{-1}$
Cattle: 24 m beef	112	6.2	1.06	0.53
18 m beef	103	7.3	1.02	0.68
cereal beef	90	12.2	0.44	0.44
veal	47	23.4	0.36	0.90
Fat lamb (off grass)	14.	12.2	0.84	0.84
Bacon pigs: breeder/feeder	28	22.8	0.44	0.94
feeder	29	22.0	0.17	0.56
Broiler chicken	1.7	23.7	0.15	0.73

From A.J.F. Webster (1979) "Healthy animals, healthy profits," Proc. Reading University Agriculture Club 1979.

Deep Woodchip Litter: Hygiene, Feeding, and Behavioral Enhancement in Eight Primate Species

Arnold S. Chamove, James R. Anderson, Susan C. Morgan-Jones, and Susan P. Jones

Sixty-seven animals from eight primate species were used to assess improved husbandry techniques. The presence of woodchips as a direct-contact litter decreased inactivity and fighting, and increased time spent on the ground. Placing food in the deep litter led to further behavioral improvement. The use of frozen foods improved food distribution and reduced fighting in most situations, especially when it was buried in the litter. With time, the litter became increasingly inhibitory to bacteria. The results suggest that inexpensive ways of increasing environmental complexity are effective in improving housing for primates.

Introduction

A desirable objective in the management of captive animals is the creation of an environment adequate for the animals' physical and emotional needs. This is especially true for nonhuman primates in whom social, physiological, and intellectual pathololegies result when important environmental considerations are neglected (McGrew, 1981). Environmental enrichment can be achieved by providing electrical and mechanical manipulanda (e.g., Chamove, in prep.; Markowitz and Woodworth, 1978; Murphy, 1976), or appropriate social stimulation (Chamove, 1973), or by attempting to approximate a more natural environment, for example by providing the animals with a deep-litter substrate on floors that were bare (Chamove and Anderson, 1979). The present article reports the results of the three studies concerned with two techniques of enhancing captive conditions for primates. Two studies examined the suitability of woodchips as a deep litter for various primate species. The third study also evaluated the effects of freezing fruit on its distribution and on aggressive behavior during feeding in a macaque group.

Study 1

A previous paper (Chamove and Anderson, 1979) suggested that litter was an effective floor covering for captive macaque groups. The rationale for its use was as follows: If an animal in its natural environment spends a substantial amount of time exhibiting a particular type of behavior, e.g., searching for food, while the animal in captivity is prevented from engaging in similar types of activity, the distortion in the animal's usual pattern of activity might be stress-

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ful for the animal, leading to abnormal behaviors (Dawkins, 1980; Hediger, 1968; Meyer-Holzapfel, 1968). In captivity, food is usually presented once or twice per day, and it is therefore located and consumed in a short time. This contrasts with the extensive amount of time, up to 70 percent, that is spent in foraging activities in the wild (see references in Clutton-Brock, 1977; Harding and Teleki, 1981).

A second argument for the use of litter is an aesthetic one. Waste products are normally avoided by monkeys, but this is difficult when wastes are excreted onto solid floors. If monkeys avoid spending time on the floor of their cage because it is soiled, the area is being used inefficiently. Alternatively, the monkeys may be forced to spend time on a floor which they find aversive. Litter can serve to cover and absorb urine rapidly, and decompose feces. This study is an attempt to generalize the results of our previous pilot study of woodchip litter using stumptail macaques (Chamove and Anderson, 1979) to a variety of other primate species.

Method

The seven species of monkey and one prosimian that were studied were moustached guenons (*Cercopithecus cephus,* N=8), vervets (*C. aethiops,* N=4), ring-tailed lemurs (*Lemur catta,* N=3), stumptail macaques (*Macaca arctoides,* N=6), squirrel monkeys (*Saimiri sciureus,* N=7), black-capped capuchins (*Cebus apella,* N=7), red-bellied tamarins (*Saguinus labiatus,* N=4), and common marmosets (*Callithrix jacchus,* N=3). All were housed in Edinburgh Zoological Gardens, with the exception of the tamarins who were housed in a room in the Stirling University Psychology Primate Unit. The seven Edinburgh groups lived in indoor-outdoor enclosures. The outdoor areas contained dead trees and either grass or gravel on the ground. The floors of the indoor areas were of epoxy cement, and only this area was used for the study. Only the stumptails and tamarins had previous experience with woodchips on the floor.

Four conditions were studied: (1) baseline, *i.e.,* bare floor; (2) woodchips on the floor; (3) woodchips plus grain; and (4) woodchips plus mealworms. Two days of observation were conducted under the first three conditions and 1 day under the fourth. Following the 2 days of baseline observation, new woodchips were spread on the floors to a depth of approximately 4 cm. One week later, observations were undertaken under this, the *woodchip* condition. On the following day, 500 g (approximately 800 cc) of mixed grain was scattered and raked into the woodchips, and 30 minutes later the group was tested (see below for the testing methodology). This procedure was repeated the following day, using one-third of this amount of grain. These 2 days constitute the *woodchip + grain* condition. The grain mixture contained primarily millet seeds, with a small amount of peanuts, sunflower seeds, dried currants, wheat, and kibbled corn. The following day, five mealworms per animal were scattered onto the litter, and 30 minutes later the group was observed in this *woodchip + mealworm* condition.

Each test involved one experimenter monitoring the group for 20 minutes between 2 and 4 p.m. A metronome sounded every 10 seconds, and any behavior occurring during each interval was noted once. Threats, rough grabbing, and biting were recorded as aggression; grimaces, cowering, and fleeing were scored as fear. Stereotyped movements, bizarre postures, and self-aggression constituted "abnormal" behaviors. Affiliative behavior involved grooming or huddling with another animal. Foraging was defined as manipulating the woodchips and intermittently transferring items found

in the woodchips to the mouth. All scores were converted to a percentage of the intervals during which the subject was visible, *i.e.*, indoors. The data were analyzed using analyses of covariance. The percentage of time each subject was observed on the ground on the first 2 control days, the *bare* condition, was used to obtain a measure of arboreality, which was then used as a covariate (see Table 1).

Three analyses of covariance were performed. All included species (N=8) and condition (N=4) as factors. In addition, percentage of time spent inactive or asleep was used as a repeated measure in one analysis, as were "negative" behaviors, *i.e.*, aggression, fear, and abnormal activities, while "positive" behaviors, *i.e.*, play and affiliation, were employed in the second analysis. The third analysis used percentage of time on the floor, percentage of time engaged in foraging, and time spent outside as repeated measures. Alpha was set at .05, and all reported differences are significant beyond this level unless specifically stated otherwise. The Least Significant Difference (LSD) method was used to further evaluate significant effects.

Results

The results from all three analyses suggested that the addition of woodchip litter altered behavior. Surprisingly, the covariate had little effect: its largest beta estimate was only 0.20 for the analysis of foraging, indicating that the effect of the woodchip litter was not related to the degree of arboreality of the species. The forage analysis (Fig. 1) revealed two interesting effects (condition X behavior, and species X condition X behavior, both $P < .001$): (1) All species spent more time on the ground when it was covered with woodchips than when it was bare, and (2) when grain was incorporated into the litter, a further increase was noted. Since the foraging scores were very similar to the scores for the time spent on the ground, only the latter are plotted.

The social behavior analysis showed a significant condition X behavior effect ($P < .005$), and a significant species X condition X behavior interaction ($P < .05$). The positive and negative behavior scores are plotted in Fig. 1. Plots of the observed frequency of the two negative behaviors were parallel for the four sets of condi-

TABLE 1. Time on the ground and agonistic behavior in eight species in different conditions

Species	N	Time on ground in bare condition (%)	Time on ground in most effective condition (%)	Time exhibiting agonistic behavior (%)	
				BARE	WOODCHIPS
Guenon	8	39	68*	.20	.09
Vervet	4	17	26*	.11	.02
Lemur	3	9	87	.14	.10
Stumptail	6	8	80	.63	.18
Squirrel	7	5	13*	.20	.01
Capuchin	7	1	28	.13	.14
Tamarin	4	2	14	.52	.10
Marmoset	3	0	11	.40	.06

*In these 3 cases, the most effective condition was woodchip + mealworm; otherwise, it was woodchips + grain.

tions, but this was not true of the two positive behaviors.

With woodchips, the relative proportion of affiliative behavior making up the positive category decreased as the environment provided was made more interesting; play was 3 times more frequent than affiliation in the bare condition, 5 times more frequent in the woodchips-only condition, and 8 times more frequent in the woodchips + food conditions. With woodchips, the subjects showed less negative and more positive behavior, in comparison with the bare condition. Grain added to the litter reduced the level of positive behavior, probably because of its distracting effects. The activity analysis showed significant effects of species X condition, and condition X behavior (both $P < .001$).

Because sleep rarely occurred, only percentage of time spent inactive is plotted in Fig. 1. The provision of woodchips decreased inactivity.

These results suggest that the mere presence of litter leads to positive behavioral changes, even after the novelty effects of its presence have passed. All species were less inactive; all except squirrel and vervet monkeys showed more play; all except capuchins engaged in a lower frequency of abnormal and agonistic behaviors; and all except marmosets spent more time on the ground foraging. The addition of grain or mealworms to the woodchips greatly increased the time spent on the ground, reduced inactivity, reduced play and affiliative behaviors, and tended to reduce aggression even further than with litter alone. Grain was particularly attractive to the stumptail macaques, lemurs, and vervet monkeys, while mealworms were particularly attractive to the tamarins and moustached guenons. This effect is shown in Table 1, which gives the condition that produced the greatest amount of time on the ground for each species.

Study 2

Study 1 confirmed and extended the finding that the use of woodchip litter with captive monkeys leads to positive behavioral changes. Furthermore, in our previous report the chips were shown to be inexpensive; after 6 weeks, odor was less than with bare floors, and the animals and walls appeared cleaner when woodchips were provided than when there was no floor covering but daily cleaning was performed (Chamove and Anderson, 1979).

One criticism of using litter with monkeys focuses on the danger of a buildup of disease, with the implicit assumption (Department of Health, Education, and Welfare, 1972) that the longer the litter is left down, the greater the danger. However, evidence from research on poultry litter suggests precisely the opposite, by demonstrating that mature litter is inhibitory to many disease organisms as well as to yeasts and molds (Fanelli, 1970; Snoyenbos, 1967; Tucker, 1967; reviewed in: Anon. 1978; Botts *et al.*, 1952; Duff *et al.*, 1973; Olesiuk *et al.*, 1971).

Chicks reared on old litter have lower mortality and grow more rapidly than controls. In addition, their eggs show increased hatchability (Botts *et al.*, 1952). The mere presence of old or new litter was shown by Duff *et al.* (1973) to eliminate the spread of salmonella among experimentally infected chicks. Although salmonellas survive for 3 to 4 weeks in feces (Berkowitz *et al.*, 1974), in used litter they are substantially destroyed within 3 to 5 days (Olesiuk *et al.*, 1971). The mechanism of salmonellacidal action is unclear, but there are suggestions that the increased moisture content (up to 20 percent), coupled with the high ammonia concentration and resulting alkalinity, are the critical factors (Turnbull and Snoyenbos, 1973). Study 2 assessed the potential for the spread of disease in litter used with macaque monkeys.

Method

Twenty-five stumptail macaques (*Macaca arctoides*), with a mean weight of 6.5 kg, were housed in an area composed of an indoor colony room and two outside areas of 33 sq m and 20 sq m respectively (described and illustrated in Chamove, 1981). All cages were interconnecting, and the animals were free to roam throughout the three areas. The outside pens were covered with mesh and partly covered with clear plastic. The floor area of each of the outside pens was covered with three 40-kg bales of woodchips. Twelve samples were taken from weeks 0 to 8 during July and August 1981. The samples were collected randomly from five different areas of a pen and mixed. Figure 2 illustrates members of a group of 25 stumptail macaques foraging through woodchips in an outside pen. Chips are covering only half of the pen floor.

Microbiological Analysis. One gram of the litter was taken, and serial dilutions were prepared using 1/4-strength Ringer solution (Oxoid no. BR 52) as the diluent. Appropriate dilutions were plated on nutrient agar (Oxoid no. CH 3) using standard techniques (Ministry of Agriculture, Fisheries and Food, 1968) Coli-aerogenes bacteria were counted at 30°C (Meynell and Meynell, 1970), using MacCartney broth (Oxoid no. CH 5a). All tubes showing acid and gas production after 48 hours were subcultured into duplicate tubes of fresh media; one tube was incubated at 37 ± 1°C, and the other at 44 ± 0.25°C.

Because salmonella is such a common and serious disease-producing organism in monkeys (Chamove *et al.*, 1979), the inhibiting effect of the litter on *Salmonella typhimurium* was assessed by inoculating approximately 10^3 organisms into 1 g of litter in a MacCartney bottle

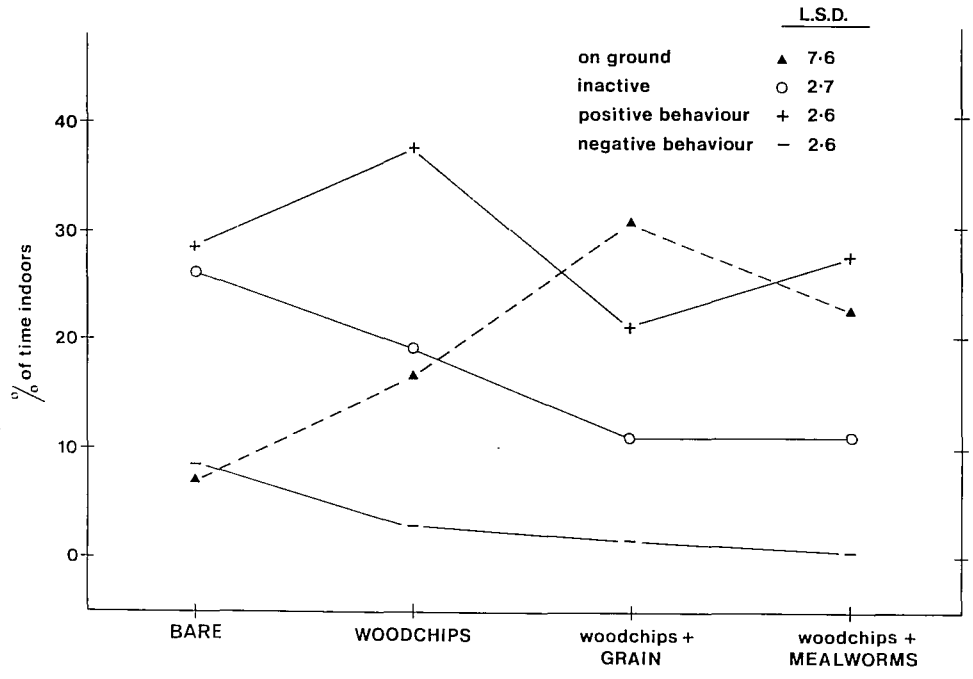

FIGURE 1. Behaviors as percentages of time when subjects were visible. Positive = affiliation + play, negative = agonistic + abnormal. The Fisher's LSD values are for the condition X behavior interaction.

FIGURE 2. Macaques search through litter for grain in the test area.

and then shaking and incubating it at 22°C for 48 hours. The numbers of salmonella organisms in the litter after storage were estimated using the method described by Morgan-Jones (1982).

Results

Correlations of times (age of litter, expressed in weeks) with bacterial counts ranged from −.41 for the total count to −.60 for salmonella, and between −.70 and −.76 for the three coliforms. Although pH and percentage of dry matter correlated highly with week number (r = +.65 and −.59, respectively) and also with one another (r = −.60), the correlation between pH and week number did not seem to be caused by moisture content, since partialling out percentage dry matter did not substantially reduce the correlation (r = +.50).

Similarly, with one exception the correlation of bacterial inhibition with week number was not accounted for by either moisture content or pH of the litter. Partialling out the variance due to percentage of dry matter reduced the bacterial correlation with week number by only .04, on average; partialling out pH reduced it by only .03, except for the 37°C test (.14) and the total count, where it actually increased by .25.

It is clear from Fig. 3 that the total bacteria count decreased over the weeks. This was also true for coliforms isolated at 30°C, which include coli-aerogenes of both animal and nonanimal origin; 37°C, which reflect coliform bacteria of fecal origin; and 44°C, which reflect coliforms of very recent fecal origin. The survival tests for inoculated salmonella showed a similar pattern of reduced survival over the weeks. The numbers of salmonella

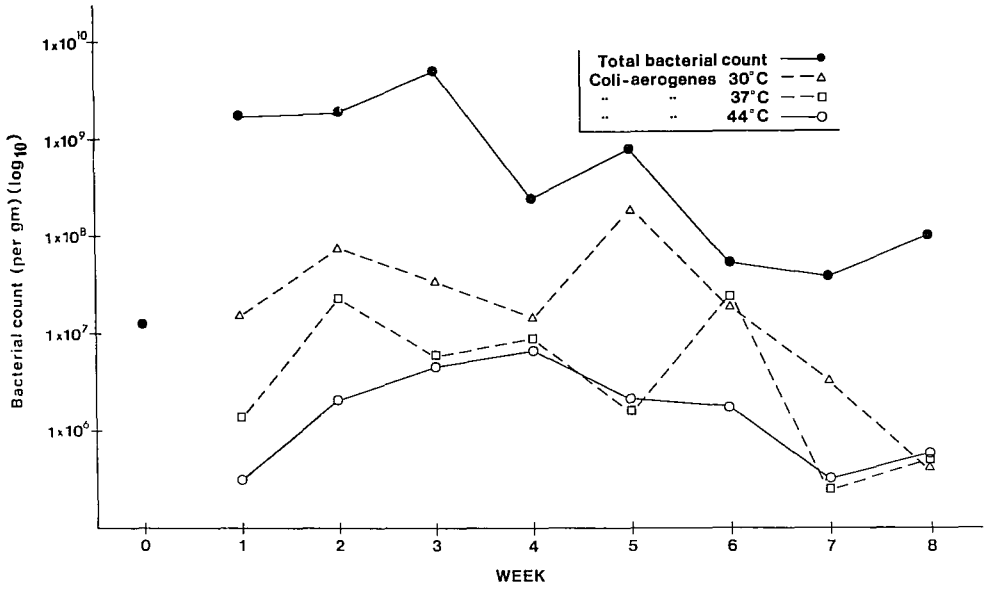

FIGURE 3. Microbiological analysis of litter.

rose from 2.9 x 10^4 per g in week 0 to a maximum of 2.4 x 10^6 in week 1, then gradually declined to a minimum of 4.3 x 10^1 by week 8 (weeks 2 to 7: 2.4 x 10^4, 3.3 x 10^4, 3.3 x 10^4, 4.6 x 10^3, 1.5 x 10^4, 1.1 x 10^3, 2.3 x 10^2). It is of interest here that the monkey litter was as inhibiting to salmonellas as is poultry litter (Morgan-Jones unpublished data).

These results show that the use of litter will not increase the risk of bacterial disease transmission and in fact appreciably reduces that risk. We have observed that after a period of about 12 weeks the monkeys spend less time on the litter and are less interested in searching through it. This behavioral criterion is useful in the scheduling of litter changes; we have decided that renewal every 4 to 6 weeks is optimal at our population densities.

Study 3

Fresh fruit and vegetables are usually given to captive monkeys to relieve the boredom of standardized diets. Two problems that often occur when feeding group-housed animals are: (1) the dominant animals are able to expropriate a disproportionate amount of the food, and (2) the food is eaten too quickly. We have observed that feeding solidly frozen fruits and vegetables to monkeys leads to better distribution and longer feeding times (Chamove, 1981), and have been using this method for the past 7 years with no ill effects. Study 3 was carried out to quantify and verify our earlier observations.

Methods

The Stirling colony group of 25 stumptail macaques was used. Their ages ranged from 6 months to 8 years, with a mode of about 2 years. Four experimental comparisons were made. (1) To assess the influence of incentive, three foods were offered in decreasing order of preference—banana, apple, and carrot. (2) To assess the effect of manner of distribution, food was either

massed in two piles or distributed evenly over the floor area. (3) To assess the effects of inter-animal visibility, the food was either distributed in the outside area where all subjects could see one another when feeding, or distributed over the same area inside where four opaque dividers with openings restricted visual contact among subjects. (4) To assess the effects of visibility of food, the food was either distributed on a bare area of the outside floor as above or buried under woodchips in the same area.

In all conditions two tests were run, one using fresh food, the other using frozen food. In all tests except experiment 1 the food used was apple. In each test the total weight of the food, cut into 45 pieces, was 1.25 kg.

Four measures were recorded on nine selected animals. The measures were (1) the number of food items eaten, *i.e.,* picked up and more than one bite taken from it; (2) the number of items eaten plus sampled, *i.e.,* dropped after only one bite was taken from it; (3) the number of agonistic interactions; and (4) the time that elapsed until all of the food had been consumed.

The analysis used analyses of variance with subjects divided into dominant (N = 2) and subordinate (N = 7) subgroups. All results reported below are significant beyond the .05 level unless specifically stated otherwise.

Results

Figure 3 illustrates the major significant differences observed. Under the condition in which food was distributed, freezing the food reduced aggression by a factor of 3 but had only a slight positive effect on distribution of food among the animals. In general, as the possibility of the dominant monkeys seeing and controlling all the food items decreased (under the conditions displayed from left to right in Fig. 4), the amount consumed by the dominants decreased, the amount eaten by the subordinates increased, and aggression was reduced. This effect was accentuated when the food was frozen.

The behavior of the dominant pair was more complicated. When the food was massed in two piles and frozen, the long feeding time led to aggression as the dominants attempted to control the two piles. When the food was distributed, fresh, and visible, aggression was also common due to attempts at control by the dominant subjects. Freezing the food reduced this aggression.

The test conducted inside, where dividing partitions restricted inter-animal visibility, was over in 2 minutes when fresh food was used, and aggression was infrequent. Aggression was slightly increased in the test using frozen food, which lasted much longer—24.3 minutes. Corresponding durations from the tests done outside were 6.4 and 19.0 minutes. To provide some perspective on these values, an adult stumptail eats an apple in about 1.8 minutes and a banana in about 0.9 minutes. A frozen apple or banana takes about six times as long to eat.

In the tests involving three types of distributed food, the dominants ate relatively more of the two preferred foods when it was offered fresh than when it was frozen, but not of the carrot. Aggression by the dominant monkeys was over four times greater for banana and apple when these were fresh than when they were frozen, but aggression was roughly equal (when fresh) and much lower (frozen) for the carrot.

Discussion

The results of the present studies clearly show that there are advantages to using woodchips as a substrate for monkeys. These data thus support the conclusions reached in a previous study

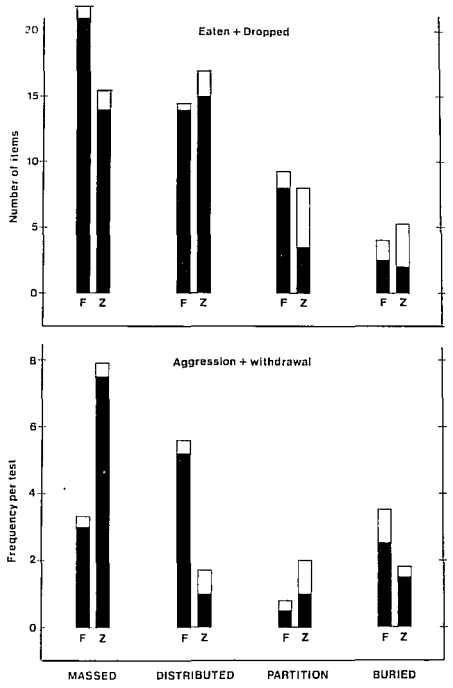

FIGURE 4. Amount eaten and agonistic rate in fresh (F) and frozen (Z) food conditions. Dominant animals, solid bars; subordinate animals, open bars. LSD = 2.4 (top) and 1.0 (bottom).

with stumptail macaques (Chamove and Anderson, 1979). In the present study, using more species, aggressive behavior was reduced by a factor of 3 with woodchips and by almost 10 times with grain or mealworms added to the litter. All negative behavior decreased by a factor of over 5 when food was added to the woodchips. Time spent on the ground almost doubled with woodchips, and more than doubled when food items were added to it. These effects occur in monkeys of various ages. Figure 5 illustrates a group of stumptail monkeys foraging through woodwool, another type of litter we are evaluating. We have observed that it does not "pack" in the same way as woodchips do, and may therefore be left down longer.

In addition to searching through the two types of litter, juvenilesalso engage in playful gymnastics in them, more so than on a bare floor, and more on woodwool than on woodchips.

In addition, there is no evidence that using woodchips presents a health hazard. As the litter matures, the woodchips become increasingly more inhibitory to bacterial survival. This self-sterilizing action makes it likely that the mere presence of an absorbent litter greatly reduces the probability of disease spread due to fecal contamination.

The freezing of food also has advantages in certain situations, leading to improved distribution and less fighting. This is particularly true when the dominant animals cannot "control" the food sites. Distribution of the food *per se* in a small enclosure may not reduce aggression, because the dominant animals may try to monopolize most of the food that they can see. One method of reducing the dominant animals' ability to control the food—burying it—resulted in improved distribution and prolonged feeding times. We regularly bury small food and non-food items in the woodchips, which the monkeys seem to enjoy discovering.

In conclusion, we recommend deep litter as one technique of enhancing conditions for captive primates. It has real potential for promoting good health and induces positive kinds of behavior among species that invest a great deal of time and energy in foraging in their natural environment.

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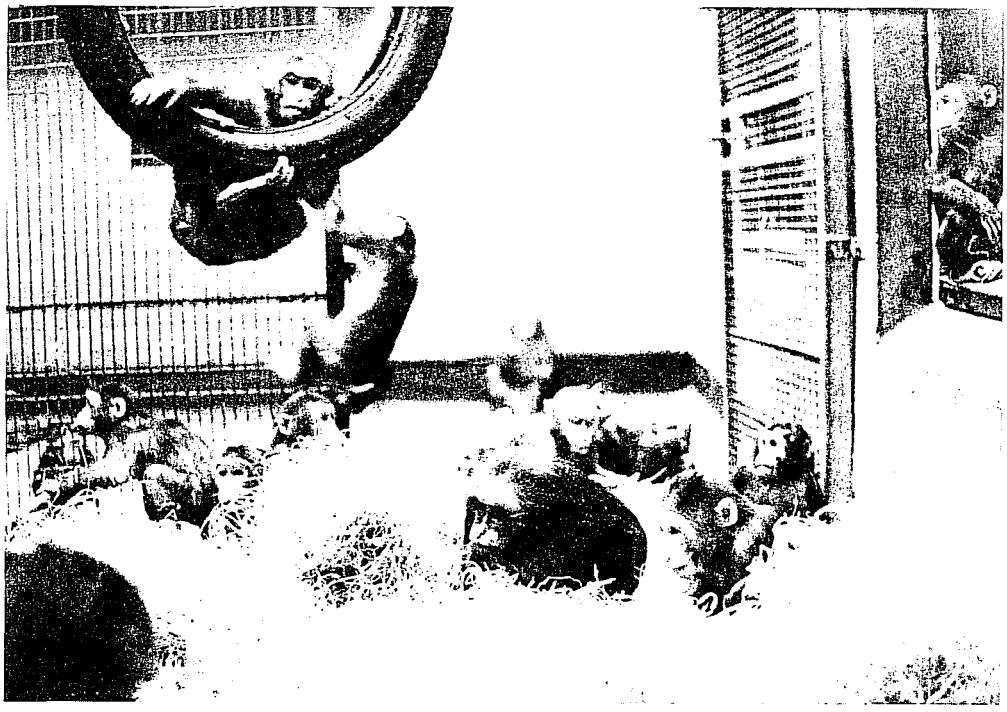

FIGURE 5. Macaques foraging on wood-wool litter.

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Introduced Species and the Issue of Animal Welfare

Michael Hutchins, Victoria Stevens and Natasha Atkins

Recently, considerable debate has been heard about the control or elimination of introduced or "exotic" animals on publicly held U.S. lands. Species introductions, whether intentional or unintentional, seem to be an inevitable result of human activities, but they may result in both economic and ecological problems: It has been estimated that over 90 percent of all such introductions have been harmful in some respect. Control of exotics can be accomplished through containment, shooting, poisoning, reintroduction of native predators, introduction of disease organisms, live capture and removal, and reproductive inhibition.

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Those who must make decisions about the fate of introduced species need to seek a balance between the rights of the individual animals and preserving the viability of whole ecosystems. One important consideration is that, although the control of exotic animal populations may adversely affect individual sentient beings, inaction may cause widespread suffering to many species and consequent loss of biological diversity.

Zusammenfassung

Eine heftige Debatte betraf kürzlich das Thema der Kontrolle oder Eliminierung von eingeführten oder "exotischen" Tieren auf Land in öffentlichem (US) Besitz. Die Einführung von Tierarten, ob beabsichtigt oder unbeabsichtigt, scheint ein unvermeindliches Resultat menschlicher Aktivitäten zu sein, doch rufen sie sowohl wirtschaftliche wie oekologische Probleme hervor. Schätzungsweise hatten über neunzig Prozent dieser Einführungen in gewisser Hinsicht eine schädliche Wirkung. Eine Kontrolle von Exoten kann erreicht werden durch Abriegelung, Erschiessen, Vergiften, Wiedereinführung von heimischen Raubtieren. Einführung von Krankheitserregern, Fang und Entfernen, sowie Geburtenkontrolle.

Diejenigen, welche die Entscheidung über das Schicksal eingeführter Tierarten treffen, müssen für ein Gleichgewicht sorgen zwischen den Rechten der einzelnen Tiere und der Erhaltung der Lebensfähigkeit des gesamten Oekosystems. Obwohl die Kontrolle exotischer Tierpopulationen sich schädlich auf einzelne empfindsame Lebewesen auswirken kann, ist es wichtig daran zu denken, dass Inaktivität ungeheures Leid für viele Tierarten bedeuten und demzufolge den Verlust der biologischen Vielfalt hervorrufen kann.

Introduction

There has been considerable controversy over attempts to control or eliminate introduced or "exotic" animals on federally managed lands in the United States. Some resource managers and conservationists argue that exotic animal populations should be controlled, since they cause considerable habitat disruption, prey on or compete with native fauna, and alter natural ecosystems. This view has been hotly contested by some animal welfare and animal rights organizations, which have objected to the proposed methods of control, especially those that involve harrassment or killing. In some instances, such as the case of the Grand Canyon burros, differences of opinion have led to long and costly court battles (Laycock, 1974; Reiger, 1980; Stocker, 1980). The purpose of this paper is to examine the introduced species issue in more detail, paying particular attention to the interests of animal welfare/animal rights advocates. Our discussion will focus on introduced mammals, because these animals, since they are both sentient and appealing, comprise the principal focus of animal welfare/animal rights concerns.

Origins of Exotic Species

One of the many ways in which humans alter their environment is by transporting organisms across natural barriers to dispersal. By definition, exotic animals are those that do not occur naturally, either presently or historically, in a particular ecosystem. An introduction is defined as the release, escape, or establishment of an exotic animal into a natural ecosystem. Introductions can be differentiated into two basic types: purposeful and accidental (Courtney, 1978).

Purposeful introductions are those that are made for a reason, usually to fulfill some real or perceived human need. For example, reindeer were introduced to Alaska to provide the mining industry with a means of transporting freight, provisions, and correspondence through harsh, subarctic terrain. They were imported to become "to the far north what the camel is to desert regions" (Jackson, 1897). Sportsmen and game managers have been responsible for numerous introductions. A desire to hunt familiar or fashionable game led European settlers in New Zealand to import a variety of large herbivores, including the chamois, red deer, and Himalayan tahr. This tradition has also been followed in the United States, where exotic ungulates, such as the European wild boar, Barbary sheep, and Nilgai antelope, roam the forests, deserts and plains—sometimes in considerable numbers (Laycock, 1966).

Some introductions have occurred in a deliberate effort to eliminate exotic species. For example, the mongoose was imported to Hawaii in an attempt to control the Norway rat—also an immigrant and a significant agricultural pest (Laycock, 1966; Randall, 1971). The purpose of other introductions has been to make animals available for human consumption. In the eighteenth and nineteenth centuries, domestic goats and sheep were routinely placed on oceanic islands such as Hawaii and the Galapagos Islands to serve as a source of fresh meat for the crews of ships sailing in remote seas (Coblentz, 1976).

Accidental introductions include any that occur unintentionally (Courtney, 1978). For example, the ubiquitous house mouse and Norway rat entered North America as stowaways on ships (Elton, 1958). The European rabbit, which is commonly raised for human consumption, has been a frequent escapee. Millions of feral rabbits inhabit Australia and other oceanic islands (Holdgate, 1967; Roots, 1976). In addition, domestic cats and dogs often adopt a feral or semiferal existence in the vicinity of human habitation (Denny, 1974).

A case that appears to fit well within either classification is that of the feral burros that roam the southwestern United States. Domestic burros were brought to North America in the sixteenth century by the Spanish, who used them as beasts of burden (McKnight, 1958). In the mid to late 1800's, burros were also used by American prospectors who, upon abandoning their dreams of unlimited wealth, released their animals into the desert. Since they were descended from the African wild ass (*Equus asinus*), which is adapted to arid climates, the introduced burros proliferated, and thousands are believed to inhabit the region today. The burro was originally brought to North America as a beast of burden and therefore represents a purposeful introduction; however, its release and subsequent establishment into North American ecosystems are consequences that perhaps cannot be called purposeful, in the true sense of the word.

Ecological Effects of Exotic Species

Species introductions are common and, whether intentional or unintentional, they seem to be an inevitable result of human activities. Why, then, are some resource managers and conservationists so adamant about controlling or eliminating exotic animals?

Concern about exotic animals can be divided into two categories: economic and ecological. Economic concerns include the problems related to financial losses caused by exotic animals, such as those that result from the destruction of agricultural crops or from competition with livestock. While such

problems may be important, we will not focus on them here. Instead, we will concentrate on the relationship between native ecosystems and introduced animals, because it is this issue that generates some difficult philosophical questions.

An impressive literature exists on the ecological effects of introduced mammals, and it is estimated that over 90 percent of all such introductions have been harmful (Roots, 1976). This is not surprising when one pauses to consider the nature of ecosystems. Having evolved over many millenia, ecological systems are like vast, finely tuned machines made up of numerous interrelated parts. The integration of the parts is responsible for the machine running smoothly. In ecosystems, the "parts" are organisms or important environmental features, which may be intricately interrelated and interdependent. Following this line of reasoning, the introduction and successful establishment of an exotic species can be likened to throwing a wrench in the machine and having it "foul up the works." Of course, unlike machines, ecosystems can continue to "operate" after the introduction of nonnative organisms, but they may be altered significantly in the process.

Perhaps the most pervasive ecological disruption caused by introduced mammals is the destruction of soils—the basis of much, if not all, of terrestrial life (Fig. 1 and 2). A dramatic example of soil damage caused by an exotic mammal is the transformation that took place on the island of St. Helena following the introduction of domestic goats. In 1501, this subtropical island in the Atlantic Ocean was densely covered with forest vegetation, but in 1513 goats were imported by the Portugese. With an abundant food supply, and no predators or competitors to limit their population,

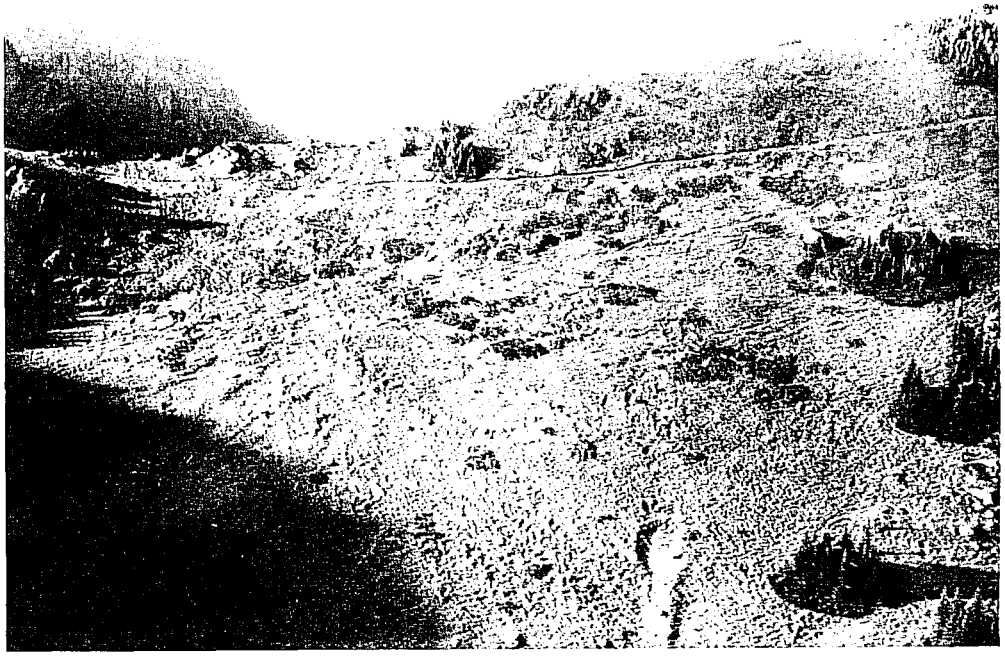

FIGURE 1 Aerial photography showing trails, dust-bathing sites, and erosion caused by introduced mountain goats in fragile alpine vegetation—Olympic National Park. (Photo by M. Hutchins)

FIGURE 2. Aerial photograph, Olympic National Park. (Photo by M. Hutchins)

the animals multiplied rapidly. Hoards of foraging goats decimated vegetation on the island's steep slopes and, in the absence of plant cover, tropical rainstorms washed away much of the topsoil. Today, the island's landscape is barren, and native vegetation survives only on cliffs that are inaccessible to the goats (Holdgate, 1967).

By reducing vegetative cover, introduced herbivores can also affect the water storage capabilities of mountain slopes. New Zealand is an island country that has no large native mammalian herbivores. The region's natural vegetation evolved in the absence of heavy grazing pressure, and therefore did not develop chemical or physical adaptations for protection. (Plants with a history of exploitation by herbivores tend to evolve adaptations such as toxins, thorns, or rapid growth and reproductive rates to protect them from their "predators.") After deer and other ungulates were introduced to the west coast of New Zealand, the vegetative cover was severely reduced. With few plants to stabilize the soil or to retain moisture, ground water runoff led to excessive erosion, silting of rivers and streams, and large fluctuations in stream levels (Roots, 1976).

There are numerous accounts of habitat modification caused by introduced herbivores (Baker and Reeser, 1972; Baldwin and Fagerlund, 1943; Bratton, 1974, 1975; Coblentz, 1977, 1978; Carothers *et al.*, 1976; Hamann, 1975; Howard, 1964; Hutchins and Stevens, 1981; Mark and Baylis, 1975; Muller-Dombois and Spatz, 1975; Pickard, 1976; Spatz and Muller-Dombois, 1973; Wardle, 1974; Yocum, 1976). In some cases, these animals have caused significant alterations in plant community structure by foraging preferentially on some species and rejecting those that are unpalatable. In other instances, trampling of fragile soils has created ideal conditions for disturbance-adapted exotic plants, which may outcompete native species. In many cases, introduced herbivores have been strongly implicated in the elimination or near elimination of native plants (Fig. 3-6).

In the course of changing the composition of plant communities, or reducing the degree of plant cover, introduced

FIGURE 3. Feral goats on Santa Catalina island off the coast of California. Note the lack of vegetation. (Photo by B. Coblentz)

herbivores may also affect native fauna. These effects can be direct or indirect. An indirect effect is illustrated by the endemic land iguanas and their predators, the hawks, on Barrington Island in the Galapagos. Because of the cover afforded the iguana by vegetation, these species had coexisted for thousands of years. However, introduced goats ate much of the vegetation, leaving the

FIGURE 4. Coffee Pot Canyon on Santa Catalina Island. Introduced domestic goats reduced the plant cover, thus resulting in extensive erosion. (Photo by B. Coblentz)

FIGURE 5. Fence erected on Santa Catalina Island. The right side is goat-free. Note the differences in vegetative cover. (Photo by B. Coblentz)

iguanas with no place to hide in time of danger. As a result, they were captured more frequently by the hawks, and were soon threatened with extinction (Dowling, 1964). Non-native herbivores also compete directly for food and other resources with native animals. For example, seed-eating birds became extinct on Guadalupe Island in Mexico following the importation of domestic livestock, which consumed many of the same plants (Greenway, 1958). In addition, it has been suggested that introduced ungulates, such as the burro and Barbary sheep, have contributed to the decline of the native bighorn sheep (*Ovis canadensis*) in the southwestern United States (Hansen, 1980). One study found that the diets of burros and bighorns overlap by as much as 52 percent (Walters and Hansen, 1978), and it follows that any vegetation eaten by feral burros would not be available for the bighorns (Fig. 7).

While introduced herbivores (primarily ungulates) cause the most severe habitat alteration, non-native carnivores have been responsible for the greatest number of species extinctions. For example, the introduced mongoose of Hawaii preys on birds' eggs and nestlings; on the island of Molokai, this predator was responsible for eliminating the dark-rumped petrel and Newell's shearwater. Kauai is the only main island in the archipelago that has its original complement of endemic birds. Not surprisingly, it is the only island that is mongoose-free (Kramer, 1971). The introduced black rat has also been implicated in the decline or disappearance of several Hawaiian bird species (Atkinson, 1977). Feral dogs and cats cause considerable mortality in wildlife populations. For example, feral housecats prey on endemic birds and reptiles in the Galapagos Islands, Hawaii, and the West Indies (Konecny, pers. comm.; Iverson, 1978; Kramer, 1971).

Exotics can affect native animals in many other ways. Diseases carried by introduced animals may have profound effects on native wildlife species that have not previously developed an immunity. The effects can be particularly severe when native animals contract these new diseases, while simultaneously having to compete

with exotics for food and other resources. In Africa, the Cape buffalo (*Syncerus caffer*) was nearly eliminated by rinderpest, a disease imported from Asia with domestic cattle (deVos *et al.*, 1956). Internal parasites (cestodes, nematodes, and trematodes) have moved among continents in exotic animals and, in some cases, have been transmitted to native wildlife. Ectoparasites (ticks, lice, fleas, *etc.*), which carry diseases such as bubonic plague and typhus, have been imported to various regions on rodents like the black rat (deVos *et al.*, 1956).

It is evident from these examples that introduced mammals can cause considerable habitat modification, as well as affect native animal populations through competition, predation, or transmission of parasites and disease. However, there are additional "side effects" of species introductions that are much more subtle. For instance, some exotic mammals may interbreed with closely related species, and thereby alter the genetic composition of natural populations (deVos *et al.*, 1956). Often, hybridization results in offspring that are ill suited for survival or are incapable of reproduction. In Czechoslovakia, introduced domestic goats hybridized with native ibex at such a high rate that they effectively eliminated the latter (Turcek, 1951).

In summary, there is ample evidence that: (1) exotic mammals can cause significant changes in natural ecosystems, (2) such changes are usually deleterious, and (3) it is impossible to predict the nature or extent of such changes and their ultimate impact on native flora and fauna. A recognition of these facts has led some biologists to label introductions of non-native organisms as "species pollution" and "ecological roulette" (Courtney and Ogilvie, 1971).

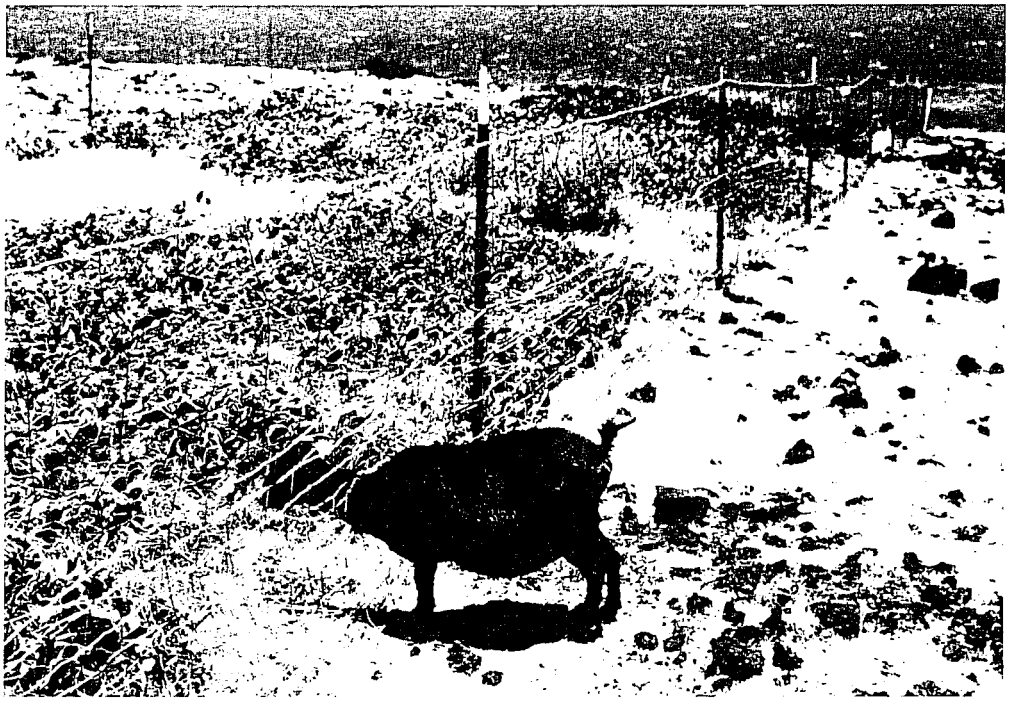

FIGURE 6. An exclosure in Hawaii Volcanoes National Park illustrates the loss of vegetative cover due to the foraging activities of introduced herbivores. A feral goat is attempting to forage on vegetation inside the exclosure. (Photo by D. Reeser)

U.S. Park Service

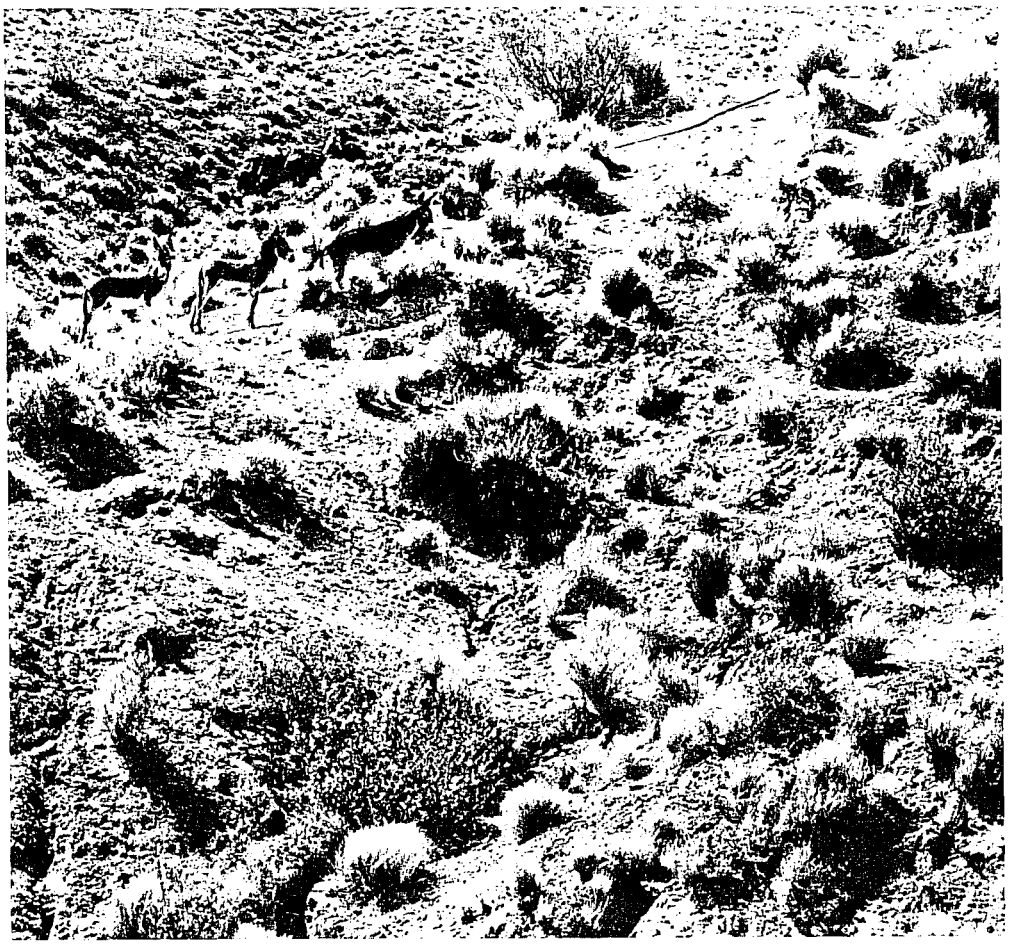

FIGURE 7. Burros brought to North America by the Spanish in the sixteenth century. Thousands now roam the deserts of the Southwest.

Controlling Exotic Animals

In an effort to preserve native ecosystems and to curb the adverse effects of introduced animals, biologists have recommended numerous methods of control. Sometimes complete elimination of the exotic is advocated, while in other cases, controlling populations at lower than current levels has been proposed. Solutions have ranged from live capture and removal to shooting and poisoning. Because the methods used to control exotics are a major point of contention between animal welfare/animal rights organizations and resource managers, we will discuss this issue in more detail.

Once it has been determined that some sort of action is necessary or desirable, resource managers must evaluate each method in terms of its feasibility, cost, potential for environmental disruption, and humane considerations.

The methods available for controlling exotic animals fall into five basic categories, each with its associated costs and benefits. The categories include: containment, direct killing (by shooting, poisoning, trapping, *etc.*), predator and disease introduction, reproductive inhibition, and live capture and removal. Field conditions and the nature of the organism generally dictate which alternatives are likely to be the most feasible.

Control through containment has been advocated in some situations. Confining exotic animals to particular areas, it is argued, can reduce environmental alteration. This is a popular alternative among many humane advocates, since it is a nonlethal solution. However, this method has several shortcomings. First, fences meant to contain exotic animals can also prevent the natural movements of native species (Carothers *et al.*, 1976). Second, by restricting the animals to a particular area, the degree of environmental modification is often intensified locally. Third, containment may not be possible because of the difficulty associated with keeping certain animals in the desired area; for species that can climb, jump or burrow, effective containment would be difficult and expensive. The nature of an animal's habitat can also be prohibitive. For example, erecting fences in rugged mountainous terrain may prove difficult or impossible. Moreover, even if the animals were effectively restricted to a particular area, periodic efforts at population control would probably still be necessary.

The use of firearms has been advocated to control feral ungulates, such as burros and goats. This method does have some advantages, such as low cost and minimal impact on the environment. However, many animal welfare/animal rights advocates find shooting unacceptable. While a well-placed bullet can result in a rapid, humane death, even the best of marksmen sometimes miss their targets. When death from shooting is not immediate, the animal may suffer pain. In addition, when shooting is done from aircraft, animals may be badly traumatized by the chase, and the probability of a humane death is much reduced.

Opponents of shooting may advocate euthanasia, but the drugs used for this purpose are often dangerous and expensive and require trained personnel to handle and inject them. In addition, if the animal cannot be captured easily before the drug is administered, such efforts can result in considerable trauma. Obviously, euthanasia is practical only when large animals are involved, and when they occur in small, relatively contained populations.

Poisons or lethal traps have been successful in controlling some animal populations, but these methods have several distinct disadvantages, the most serious of which is their ability to kill indiscriminately. In the process of controlling exotics, many native animals may be destroyed as well. In addition, many animal welfare/animal rights advocates consider these methods to be inhumane.

The reintroduction of native predators has had increasing appeal as a "natural" method for controlling populations of exotic animals. However, there is no guarantee that the predator will prey exclusively on the species targeted for control, or that the rate of predation will be high enough to significantly reduce population growth. The introduction of exotic predators to control populations of exotic herbivores is inadvisable, since there is no way to predict the range of species that they will include in their diet.

The introduction of disease organisms has also been used to control populations of exotic animals. But diseases often have the same disadvantages as toxins or traps, in that there is no guarantee that they will affect only those species designated for control. However, some disease organisms will affect only particular types of animals. The classic example of a disease organism that was used to control an exotic mammal is that of myxomytosis—a viral disease imported to Australia in an attempt to control the European rabbit. The virus was effective initially, but the rabbits eventually developed an immunity, and the virus itself became less virulent (Fenner, 1965). New strains have subsequently been introduced, with some success (B. Coblentz,

pers. comm.).

Reproductive inhibition is another possible nonlethal solution. Several methods have been attempted, but their practicality and effectiveness are questionable. Tubal ligations, castration, and chemosterilization are feasible for some animals, and have the advantage of being permanent forms of reproductive control. The disadvantage of these alternatives is that they all involve capturing and handling the animals, and may result in considerable psychological and physiological trauma. Hormone implants and orally administered reproductive inhibitors require repeated applications, sometimes on a daily basis. In addition, these methods may have deleterious side effects (Matsche, 1977a, 1977b, 1980; Seal, 1976). Methods involving surgical procedures may lead to infection or death (Zwank, 1981). Mechanical devices that prevent conception have also been developed, but were found to be ineffective and impractical (Matschke, 1976). At present, reproductive inhibition is feasible only for small or confined populations where animals can be captured easily. It is also a gradual, rather than a rapid method of control: if reproductive inhibition is used as a method for complete elimination, then environmental alteration can be expected to continue until the population eventually dies out.

Live capture and removal is another nonlethal method of population control. However, it has numerous limitations. Indeed, the animals are often subjected to considerable physical and psychological stress while being captured and transported. Some animals may suffer limb fractures and lesions as a result of falls, and some may succumb to overdose from drugs or to shock (Stelfox, 1976). Others may contract capture myopathy—an often fatal muscular disorder in hoofed animals that is induced by the trauma of capture and transportation (Chalmers and Barrett, 1977; Spraker, 1977, 1978). The specific characteristics of the host habitat may also limit the effectiveness of live capture and removal. Relatively inaccessible areas, such as mountainous terrain or dense forests, can make the location, capture, and transport of large animals difficult, if not impossible.

An additional problem limiting the effectiveness of live capture and removal is that of the ultimate disposition of the animals. Public adoption of captured exotics is feasible only for a few domestic species, such as horses and burros, and then only in limited numbers. For other animals, such as reindeer or mongooses, such a strategy is impractical. It is possible that these animals could be released in some other location. However, unless the release site falls within their native range, the animals are just as likely to cause habitat alteration in their new host environment as they were in the previous one.

In addition, a major drawback to live capture and removal programs is the cost (Fig. 8). The Fund for Animals reportedly spent $500,000 to remove about 600 burros from the Grand Canyon (Anonymous, 1981). Often, introduced ungulates are found in remote or inaccessible areas. Even if live capture and removal were feasible, expensive equipment (such as helicopters) and personnel trained in capturing and handling the animals would be necessary. Because of the exorbitant costs, most capture and transport programs must rely on a very unpredictable funding base—private-interest groups.

Discussion

In order to examine the relationship between introduced species and the animal welfare/animal rights movement, we have organized the discussion around two critical questions:

1. Are efforts to eliminate or control exotic animals—regardless of what method is chosen—incompatible with the philosophical tenets of the animal welfare/animal rights movement?

FIGURE 8. Method used to transport introduced mountain goats from Olympic National Park. This illustrates the expense of live capture and removal programs. (Photo by M. Hutchins)

The newly emergent concept of animal rights has been central to many recent debates involving animals, whether they are found on farms, in laboratories, or in the wild. Attempts to control destructive exotic mammals, such as the Grand Canyon burros, have been opposed by animal welfare and animal rights organizations whose members perceive the harrassment or death of sentient beings to be unjustified or cruel and immoral. (But see also the discussion on domestic animals, below.) However, the introduced-species issue is not as straightforward as those that involve obvious cruelty to animals. While the humane treatment of sentient animals is certainly a desirable goal, so is the preservation of natural ecosystems and native wildlife. The welfare of animals has been a concern of both the conservation and humane movements; but, despite this superficial similarity, profound differences exist. Callicott (1980) has compared the "land ethic" of Aldo Leopold (1949) with the "humane ethic" of Peter Singer (1975). While only sentient animals are afforded moral standing according to the humane ethic, the land ethic is more holistic, focusing not only on animals, but also on plants, soils, and waters. While we recognize that philosophical differences exist within

various factions of both the conservation and humane movements, we consider their radically divergent emphasis on the individual as opposed to the species or ecosystem to be a crucial issue.

We perceive many difficulties in the efforts of humane organizations to defend the rights of introduced species. Myers (1979) and Erlich and Erlich (1981) have identified habitat disruption as the most significant threat to wild-animal populations. Therefore, a concern for wild animals needs to be expressed in a willingness to protect natural ecosystems. On a superficial level, animals appear to be separate entities, moving independently and freely within their environments. In fact, nothing could be further from the truth. All living organisms are closely tied to the habitats in which they have evolved. Thus, if the introduction of an exotic herbivore leads to an alteration in plant community structure, native animals that depend on certain plants for food or cover may starve or be captured more frequently by their predators. While an effort to control or eliminate exotics may sometimes necessitate the killing or harrassment of individual sentient animals, inaction may result in widespread suffering. A difficult question for humane organizations contemplating legal or political action against government agencies that want to control introduced animals is: Are we willing to live with the suffering of the many other organisms that are adversely affected by the exotic species?

Animal welfare/animal rights advocates must also contend with the realization that many nonlethal methods of population control may be less effective and less humane than lethal methods, such as shooting. Indeed, if one's goal is to reduce pain and suffering, then the advocacy of methods such as reproductive inhibition or live capture and removal must be questioned. The exorbitant costs of live capture and removal are also ethically questionable, especially when one considers that funds are limited and could possibly be put to better use. For example, poaching and smuggling, stimulated by a lucrative wildlife trade, has helped to push many species to the brink of extinction. The half million dollars spent by the Fund for Animals to remove the Grand Canyon burros could have been used to alleviate the suffering of a greater number of animals, had it been made available to organizations like the World Wildlife Fund, whose objective is to save endangered species from extinction.

Even philosophers who argue that nonhuman animals have a "right to life" recognize that such a right is not absolute. According to Regan (1976): "There may arise circumstances in which an individual's right to life could be outweighed by other, more pressing, moral demands, and where, therefore we would be justified in taking the life of the individual in question." This attitude is reflected in the policy of The Humane Society of the United States toward stray cats and dogs. Each year, millions of unwanted pets are put to death by organizations dedicated to the promotion of animal welfare and animal rights. Ironic as this may seem, the death of countless animals is seen as an acceptable alternative to the starvation and misery that would accompany overpopulation. We believe such actions are also justifiable for wild animals, though this may be unfortunate. But we do not place the burden of moral responsibility on animals (Feinberg, 1978), and this may account for the guilt that we feel in causing them to suffer or in taking an "innocent" life. It is certainly not the fault of introduced animals that they were captured and transported to another habitat by humans. However, the fact remains that exotic species do exist and are, in many cases, causing significant ecological changes at the expense of other animals. Indeed, while we discuss the rights of introduced animals, still others may be driven toward extinction.

In transporting animals from one place to another and allowing them to remain, we rob *native* organisms of *their* "right to life." To argue that people should not have created such problems in the first place is, at this point, entirely unproductive. And to assume that our ecological problems would suddenly be solved if we "let nature take its course" is naive, since we are often forced into active management of our few remaining natural ecosystems. Human intrusions are subtle, and diverse; potential threats require constant monitoring, and once identified, may require immediate action to prevent any permanent damage.

2. Is the elimination or control of exotic animals justifiable under all circumstances? In what circumstances is it justifiable?

Some recent control programs involving federal lands have been justified by statutes authorizing the protection of native organisms and ecosystems; however, it may be difficult to justify such actions on all lands. Lands under federal jurisdiction are managed to meet their stated purpose under the law, and this may have little relevance to the preservation of natural ecosystems. For example, National Forests, wildlife refuges, and rangelands are seldom managed so as to preserve natural ecosystems, and the agencies managing these lands have come under repeated attack for allowing economic interests to take precedence over ecological concerns. In some cases, the viability of ecosystems is of concern to resource managers only when it affects the production of commercially important livestock or game animals. For example, in Olympic National Park, federal officials have recognized a need to control a population of introduced mountain goats (Hutchins and Stevens, 1981), but Washington state game managers oppose complete removal because it would eliminate hunting opportunities on adjacent lands. In addition, some of the goats captured by the National Park Service and removed to reduce pressure on the region's fragile ecosystem were shipped by state game officials to Nevada and Utah—areas well outside the animals' native range. The goats were imported to these areas specifically for the purpose of recreational hunting. If government agencies such as the National Park Service wish to justify the elimination or control of exotic animals on the premise that it will protect native ecosystems, then they must be more consistent in formulating and applying their own policies: Simply transporting the problem to another area is not a solution.

There are laws that seek to control the importation of foreign organisms into the United States (e.g., Carter, 1977); however, there are no regulations limiting the introduction of exotic species into natural ecosystems (Courtney, 1978). Protests by animal welfare/animal rights organizations have sometimes forced federal agencies into preparing Environmental Impact Statements (e.g., in the case of the Grand Canyon burros; U.S. Interior Department, 1980) to justify their removal of exotics, but no similar studies are required before new species are introduced by state game agencies.

On the basis of this discussion, it is evident that the control or elimination of exotic species cannot always be justified on the basis of preservationism; however, advocates of control can argue much more convincingly in the case of National Parks. These few areas constitute a relatively small portion of our total land area and contain the only remaining habitats that are still relatively pristine (Houston, 1971). If the control of destructive exotics is made possible on these lands, we believe that every effort should be undertaken to preserve the native animal and plant communities. At least, by exerting control on this limited geographic scale, we will have succeeded in preserving some aestheti-

cally and biologically critical areas. Advocates of control can also argue convincingly in some cases that do not involve National Parks. For example, when exotic species threaten the existence of rare or endangered native organisms that live outside park boundaries, then control can be justified. It might also be appropriate to control exotic animals on lands adjacent to parks or other sensitive areas in order to prevent recolonization.

In arguing against the control of certain exotic animals, some animal welfare/animal rights advocates have questioned whether any benefits would actually result from such actions. However, there are several instances in which the control or elimination of exotic mammals has had beneficial effects. When small exclosures were erected to study the effect of feral goats on native flora in Haleakala National Park, Hawaii, the seeds of a heretofore unknown leguminous plant began to germinate (Baker and Reeser, 1972). The elimination of feral rabbits from Laysan Island in the leeward Hawaiian chain saved the endemic Laysan teal from almost certain extinction (Warner, 1935). At the time the rabbits were eliminated, the birds' population had been reduced to less than seven individuals. Now there is a healthy population. The loss of biological diversity that could have resulted would have been a great price to pay for inaction. Myers (1979) has estimated that nearly 1 million species of animals and plants will vanish from this planet by the end of the century, if habitat destruction is allowed to proceed at current rates. While exotic species represent only one kind of habitat degradation caused indirectly by humans, they are a significant contributor to the problem.

While we recognize the need to control or eliminate some exotics in biologically critical areas, we would not argue for the elimination of all exotics. There are major obstacles to the development of effective control programs, such as their cost and the high degree to which some exotic species have become established. The high cost of control makes it necessary to set priorities—perhaps only the most destructive of non-native organisms should be targeted for action. As Darling and Eichorn (1967) have noted: "The question of the status of exotics should not cause hysterical reactions until each example is thought through." Of course, some exotics, such as the Norway rat, have become so firmly established that complete elimination has proved to be impossible. Some animal welfare/animal rights organizations have argued that federal agencies should be required to prove that exotics are in fact causing irreparable damage before control programs are implemented. While we recognize the importance of monitoring the actions of government agencies, there are several reasons for rejecting this position. First, it is impossible to predict the long-term effects of exotics on native fauna and flora, and even more difficult to quantify the nature of such effects. We really know very little about the inner workings of most ecosystems—systems of biological interdependencies can be extremely subtle, and in the absence of such information, precise prediction is impossible. Second, detailed studies of the ecological impacts of exotic animals may take years to complete and, while the irreparable damage is being documented, it may have already taken place. To some extent, resource managers must act on the basis of intuition and previous experience. If there is any evidence that significant habitat alteration is being caused by exotics, then fast and decisive action might be necessary and justifiable.

Epilogue

We have identified several difficult problems for the animal welfare and animal rights movement in defending introduced species. However, our purpose is

not to question the ethical foundations of the movement or to challenge the sincerity of its beliefs. We wish only to broaden its perspective. Michael Fox—a leading proponent of the animal welfare and animal rights movement—has argued recently for a more moderate approach to the issue of animal rights (Fox, 1978, 1979). He views the arguments of Singer (1975) and other "radical" animal liberationists as falling short of the requirements for a practical humane ethic. Indeed, many other more ardent defenders of animal rights have focused exclusively on the protection of sentient animals, and often their attention is concentrated only on those animals that are perceived as being appealing or "cute." Fox (1979) recognizes the inherent weakness of this philosophy, noting that: "The ecological imperative of responsible stewardship concerns our treatment of, and relationship with all of creation, both sentient and nonsentient." He envisions the animal welfare/animal rights movement as an important transition to a more holistic "eco-ethic." While we agree that a recognition of the rights of all living things is an important step toward the attainment of such a goal, we also stress that responsible stewardship may involve difficult, and sometimes painful, decisions. In some cases, our actions may result in the death or suffering of other sentient beings. Of course, we do not believe that cost-effectiveness should be the sole consideration in the development of animal management strategies. A society's values are just as important as its economics. When the need to control a destructive animal has been identified, then reductions should be accomplished in the most humane manner possible, given the limitations of the situation. When the purpose of such reductions is to preserve natural ecosystems or to protect endangered animals and plants, it should not be viewed as incompatible with the humane ethic.

The controversy surrounding the control of exotic animals illustrates some of the complex ethical problems that confront the animal welfare/animal rights movement, conservationists, and wildlife managers today (also see Callicott, 1980; Rodman, 1977). We believe that such problems must be confronted directly and openly if the movement is to retain its credibility and maintain its momentum. Aldo Leopold once said that "a thing is right when it tends to preserve the integrity, stability and beauty of the biotic community" (Leopold, 1949). In addition, Blackstone (1978) has observed that the environmental crisis "involves not merely what some consider to be isolated and particular problems, such as the pollution of our lakes and rivers, the smog of our cities, and the devastating effect of pesticides, on food chains; it involves a threat to life on this planet and certainly to the quality of that life." In fact, if humane organizations are unable or unwilling to broaden their perspective to encompass the whole of nature, they will risk a total alienation of the environmental community. Moreover, in adhering to a philosophy that emphasizes a reverence for life, but that ignores the conditions necessary for its survival, they may ultimately be unfaithful to their own ideals.

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FORTHCOMING ARTICLES

Feral Dogs of the Galapagos Islands—Bruce Barnett and Robert Rudd

Historical Trends in American Animal Use and Perception—Stephen Kellert

The Effects of Ethostasis on Farm Animal Behavior—A.F. Fraser and M.W. Fox

Psychological Aspects of Slaughter—Harold Herzog and Sandy McGee

A Different Approach to Horse Handling, Based on the Jeffery Method—Judith Blackshaw and Sharon Cregier

Vivisection and Misanthropy—George P. Cave

A Three-Year Review of Events in Animal Welfare: How Far Have We Come?—Editorial Board

Legislation & Regulation

Model Bill for Prohibiting Anti-Hunters Drafted by WLFA

The Wildlife Legislative Fund of America, whose letterhead asserts that its sole raison d'etre is "to protect the Heritage of the American Sportsman to hunt, to fish and to trap," has devised a model state statute for making the various tactics of anti-hunting activists illegal. And with some success: since the group began its efforts in January 1982, eight states have enacted legislation containing some, or all, of the WLFA's suggested provisions. These states are Montana, New York, Washington, Vermont, Connecticut, Michigan, Minnesota, and California.

It all began when the Animal Defense Council initiated a campaign to disrupt the hunt of desert bighorn sheep in Arizona. Their efforts were sufficiently effective that the Arizona Fish and Game Department, working with the state Attorney General, Robert Corbin (himself a hunter), decided to take a closer look at the existing laws to see why anti-hunting activity was not a punishable crime. The result of these efforts was that Arizona drafted and passed the nation's first "anti-harassment bill."

The WLFA, eager to duplicate the victory won in Arizona, had its own attorneys draw up a model bill that "goes further than the Arizona law by protecting the activities of all sportsmen including hunters, trappers, and fishermen" (quoted from a publicity package distributed by WLFA to promote the bill). The following is a verbatim copy of the bill.

Model Statute to Prohibit Harassment of Hunters, Trappers and Fishermen

Section 1. Definitions
As used in this Act:

A. "Wild animal" means any wild creature the taking of which is authorized by the fish and game laws of this state.

B. "Process of taking," in addition to any act directed at the taking of a wild animal, includes travel, camping, and other acts preparatory to taking which occur on lands or waters upon which the affected person has the right or privilege to take such wild animal.

Section 2. Harassment prohibited

A. No person shall interfere with the lawful taking of a wild animal by another, or the process of taking, with intent to prevent the taking.

B. No person shall disturb a wild animal, or engage in an activity or place any object or substance that will tend to disturb or otherwise affect the behavior of a wild animal, with intent to prevent or hinder its lawful taking.

C. No person shall disturb another person who is engaged in the lawful taking of a wild animal or who is engaged in the process of taking, with intent to dissuade or otherwise prevent the taking or to prevent such person's enjoyment of the outdoors.

D. No person shall enter or remain upon public lands, or upon private lands without permission of the owner or his agent, with intent to violate this section.

E. The maximum penalty for violation of this section is a fine of five hundred dollars and thirty days imprisonment, or both.

Section 3. Failure to obey order prohibited

A. No person shall fail to obey the order of a peace officer to desist from conduct in violation of Section 2 if the officer observes such conduct, or has reasonable grounds to believe that the person has engaged in such conduct that day or that the person plans or intends to engage

in such conduct that day on a specific premises.

B. The maximum penalty for violation of this section is a fine of one thousand dollars or ninety days' imprisonment, or both.

Section 4. Injunction, damages

A. A court of general jurisdiction may enjoin conduct which would be inviolation of Section 2 upon petition by a person affected or who reasonably may be affected by such conduct, upon a showing that such conduct is threatened or that it has occurred on a particular premises in the past and that it is not unreasonable to expect that under similar circumstances it will be repeated.

B. A court of general jurisdiction may award damages to any person adversely affected by a violation of Section 2, which may include an award for punitive damages. In addition to other items of special damage, measure of damages may include expenditures of the affected person for license and permit fees, travel, guides, special equipment and supplies, to the extent that such expenditures were rendered futile by prevention of taking of a wild animal.

Current Events

MEETING REPORTS

Farm Animals Between Production and Protection — Report on a European Conference

Introduction

Because of the success of the first European Conference on the Protection of Farm Animals, which was held in Amsterdam in April 1979, the Conference Steering Group, under the chairmanship of Mr. P.L. Brown, Chief Veterinary Officer of the Royal Society for the Prevention of Cruelty to Animals (RSPCA), was encouraged to organize a second conference on the same topic. This Second Conference on the Protection of Farm Animals was held on May 25-26, 1982 at the Palais de l'Europe in Strasbourg (France) under the auspices of the Council of Europe's Secretary-General, Mr. Franz Karasek. The Conference was attended by representatives of consumer and animal welfare interests, farm animal producers, and veterinarians from all over Europe, as well as the U.S. and Canada. The subjects discussed included (1) progress in animal protection in Europe, with reference to the work of the Council of Europe and the European Communities; (2) livestock farming, as this industry is likely to develop in Europe by the year 2000; and (3) transportation of animals, including horses, within and into Europe. The first conference session was opened by Gaetano Adinolfi, Deputy Secretary-General of the Council of Europe.

Message from the French Minister of Agriculture

During the first session of the conference, which was chaired by P.L. Brown, a message from Edith Cresson, French

Minister of Agriculture, was read. Her letter related the development of intensive farming methods to the concentration of populations in urban areas, increasing economic competition, and attempts to satisfy ever-larger consumer demands. Also, high production costs, including real estate prices, had compelled producers to intensify their production methods, in order to maintain rentability. The resulting physical and physiological constraints under which animals were being kept in these kinds of industrial establishments had aroused the concern of animal protectors, who saw these conditions as constituting veritable acts of cruelty.

It was therefore essential that the various problems posed by these rearing methods be studied in an unemotional manner, utilizing a pragmatic approach. The message also reminded conference participants that the well-being of animals ought to be the subject of technical and scientific inquiry, to establish the real physiological and ethological needs of animals. Governments should be kept informed about the results obtained from these kinds of studies on the welfare of animals, but they must also bear in mind the economic constraints mentioned above, which led to the intensification and quasi-industrialization of farming in the first place.

Concerning the transportation of animals, her letter referred to the initiative of the Council of Europe, the result of whose efforts had been the European Convention of the Protection of Animals During International Transport. This Convention was subsequently adopted by the European Communities. She noted that this conference had set for itself the task of investigating the ramifications of the various modes of transportation; the scientific findings uncovered should be used to assist responsible governments in improving transport conditions for the animals in Europe.

The Role of the Commission of the European Communities

Maurice Barthelemy, Director of Agricultural Legislation for the Directorate-General of the Commission, made note of the work of the European Communities in the domain of animal welfare. These efforts have been initiated only recently, but they have already resulted in Directives on slaughter and international transport, which have had an effect in the 10 European member states. Discussions on farm animals are now underway, in particular on laying hens kept in battery cages. Current methods of rearing pigs and calves will be covered next. However, uniform European legislation cannot be effective in protecting animals if the various national governments do not work seriously to implement the law.

The Council of Europe's Standing Committee on Farm Animal Protection

Ingvar Ekesbo, Head of the Department of Agricultural Hygiene, Faculty of Veterinary Medicine, in Skara (Sweden) described the work of the Council of Europe's Standing Committee on Farm Animal Protection. On March 10, 1976 the European Convention for the Protection of Animals Kept for Farming Purposes was ready for signature by the 21 member states of the Council of Europe and by the European Communities. At this point, 12 countries have ratified the Convention, which went into force on September 10, 1978. A Standing Committee, provided for in the Convention, was made responsible for the elaboration and adoption of recommendations to the contracting parties. These recommendations are meant to contain detailed provisions for the implementation of the more general principles set out in the Convention, and they should be based on our current state of scientific knowledge on the various species of animals. Each contracting party was given the right to appoint a representative to the Standing Committee. The following international organizations were invited to appoint experts as potential consultants: the Society for Veterinary Ethology, the World Society for the Protection of Animals, the European Confederation of Agriculture, and the Federation of Veterinarians of the European Economic Community.

The present agenda of the Standing Committee includes these topics: various aspects of swine husbandry, calf rearing, conditions of laying hens, and broiler production. The Committee began its work by elaborating and adopting recommendations for laying hens. In the course of this effort, 50 working papers were carefully studied. In December 1981, the Committee accepted unanimously a draft proposal concerning recommendations for laying hens. Since the Committee's discussions are held in private, Prof. Ekesbo could not inform the audience about specific details.

Trends in Animal Husbandry: How Things Will Change by the End of the Century

The second session of the conference was chaired by A.H.A. Nabholz, member of the Veterinary Faculty in Berne (Switzerland) and the Executive Committee of the Swiss Federation for the Protection of Animals, and also chairman of the International Society for Livestock Husbandry. J.J. Bakker, Deputy Research Coordinator in the Directorate of Agricultural Research, Ministry of Agricul-ture, the Netherlands, spoke on probable trends in animal husbandry in Europe over the next 20 years. He based his presentation on a long-range study conducted by the European Association for Animal Production (EAAP), "Livestock Production in Europe: Perspectives and Prospects."

In eastern Europe, further growth in production, in every sector, is anticipated. Also, average farm size will probably increase. However, general economic conditions in these countries will have a substantial impact on these trends, as well as on the success of feedstuff production programs. In western Europe, family farms will likely remain predominant. Many products will not see any increases in total output; therefore, two-tier-type policies will be necessary. Further rationalization of production methods and further reduction of the cost per unit should not be regulated, but maintenance of the size of the agricultural labor force, protection of the environment and its flora and fauna, and improvement of the rural infrastructure will require fresh perspectives and new policies. Some reallocation of production is expected: for example, dairy production will probably become more concentrated in northwestern Europe. *Extensive* meat production will tend to become localized in southern Europe, while *intensive* meat production will shift from its present areas of concentration to less densely populated regions. The overall role of European animal production in the totality of world food production is not expected to change significantly, according to Bakker.

Jorgen B. Ludvigsen, Head of Veterinary Research, National Institute on Animal Science, Copenhagen (Denmark), elaborated on the welfare implications of changes in the ways livestock is raised in Europe. In his view, introducing the idea of an economic recession in Europe into the equation prohibits a proper prognosis of long-term changes. While reduction of the rural population has been proceeding faster than was previously anticipated, production is nevertheless being maintained and, in some instances, has even been increased. This has only been possible because farms have taken advantage of techniques for enhancing the reproductive capabilities of domestic animals. Legal restrictions that affect animal production are not favored by producers, because of the increased costs they entail. In Dr. Ludvigsen's opinion, intensive livestock production is here to stay, and we may even see further intensification.

Though high stocking densities may affect the health of animals, we can foresee a time when most contagious diseases will have been eradicated (except foot-and-mouth disease), probably by the end of this century. Ludvigsen admitted that large-scale animal production can frequently be abusive to animals and that the conditions of animal confinement are a symptom of changes in human society. Producers simply assume that animals can adapt to new systems. He also commented that, given these forces, it will take years to accommodate the demands of the humane movement. Western Europe will continue to import animal products from countries that have no animal welfare regulations at all, although exporting countries ought to observe the same animal welfare standards as the importing countries.

In the discussion that followed this second session, debate was opened by Ruth Harrison, author of *Animal Machines,* a member of the British Ministry of Agriculture's Farm Animal Welfare Council, and Director of the World Society for the Protection of Animals. Ms. Harrison expressed her belief that any long-range projections would have to include, among other factors, the increasing public concern about the welfare of animals. In the future, therefore, replacement of existing systems must be given top priority. These new systems will require specially selected and trained stockmen. In the past, only managers, engineers, and scientists have been so trained—not stockmen. Ms. Harrison also pleaded for a more equitable distribution of the earth's resources among all creatures. The scarcity of water and feedstuffs, among other constraints, inevitably influences animal production. She also noted that the public would look to the several governments to implement the various European Conventions.

In response to a question by Dr. Ekesbo, directed to the chairman, regarding developments in Switzerland in connection with the new Animal Protection Law, Prof. Nabholz explained that the law will require producers to make some changes in their current systems. For example, egg producers are given 10 years' time to eliminate the battery cage system. Producers are now looking for new systems that will be equally profitable, but consumers may still have to pay more for eggs, because of higher production costs.

Transportation of Animals

The third to seventh sessions of the conference covered the many aspects of transportation of animals. The logistics of animal transportation within and into Europe were reviewed by W.L.A. Lockefeer of the Netherlands. The volume of international animal transportation, he found, has grown twice as fast as that of transportation within nations. Nearly 252 million animals cross the borders of Europe every year. The European Communities imported 87 million live animals (34.5 percent) and exported 164 million (65.5 percent). Moreover, 230 million live chickens are transported, as well as 10 million pigs, 6.5 million calves, and 360,000 horses. With a total domestic-animal population of 93 million, the Netherlands constitute the most important animal trading nation within the European Communities. They export about 88.3 million animals: 53.3 million of these are transported to countries in the European Communities, and 35 million animals are shipped to countries in the Third World. The Benelux countries, France, the Federal Republic of Germany, and Italy are the next highest-volume trading partners, in that order. The speaker was confident that observance of the several Directives regarding transportation that have been issued by the European Communities will guarantee the well-being of animals during transport, but pleaded for speeding up the customs-clearance procedures and for the provision of an emergency service during strikes, to avoid undue delays.

The next speaker, Sidney Burgess, a Group Managing Director of the Buitelaar Group of Companies, which are involved in livestock farming, marketing, livestock shipping, and wholesale meat and game exporting, concentrated on some of the economic factors that influence the logistics of the transportation of farm animals. Farm animals are exported from their native country to another country for further fattening or for immediate slaughter. Alternatively, they are shipped to various locations within the country of origin as they progress through the standard stages of development to maturity.

One question comes immediately to mind: Why must farm animals destined for slaughter be exported in a live condition at all? Why can't they be exported as carcass meat? Do the systems of subsidies in the European Economic Community (EEC) tend to encourage the international transportation of live animals? Mr. Burgess tried to correct a few misconceptions about this last item, the two subsidy systems. The purpose of the Monetary Compensation Adjustment (MCA) system is to establish a common marketing value, wherein the weak-currency member state pays a levy into an EEC fund, while the member states with stronger currencies receive a rebate from the

fund. The other subsidy system, known as the Third Country Refund, provides a means by which all of the member states within the EEC can market their agricultural products in countries outside of the Community at competitive prices. Butter and beef are typical products that fall in this category. To demonstrate that a preference for shipping live animals does not arise as a result of these EEC mechanisms, Burgess cited examples to prove producers have no intrinsic incentive for transporting animals alive (for either long or short distances) as opposed to shipping them in carcass form. The whole question turns on the simple economics of demand and supply. There is every indication, Burgess concluded, that there is a "shrinking demand" for live shipments. He then discussed the principal factors that can result in an animal losing commercial value because of indifferent or poor handling during transportation. His final remarks dealt with the relationship between factions concerned about welfare and commerce, and he expressed the opinion that both commerce and welfare spend too much time and effort on legislation and not enough on cooperation.

Other papers addressed various subjects: ethological problems in the transportation of farm animals in Italy (Verga Marina, psychologist and ethologist from Italy), the physiological and physical effects of transportation in species produced for meat (P.V. Tarrant, Agricultural Institute, County Dublin, Ireland), the international transportation of pigs (G. van Putten, Research Institute for Animal Husbandry, Zeist, the Netherlands), the transportation of poultry (A.R. Gerrits, Institute for Poultry Research, Beekbergen, the Netherlands), and the transportation of cattle and sheep (G. von Mickwitz, Freie Universität, Berlin).

A paper on the traffic in live horses, delivered by Major-General Roger Macchia, Inspector General of the International League for the Protection of Horses, based in Paris, met with particular interest. His report covered the transportation of horses and their slaughter. The work was based on investigations carried out by Macchia himself, who traveled over 200,000 km in the course of collecting his data. In the discussion that followed, conference participants were addressed by G. Müller, a member of the Committee on Agriculture of the Council of Europe, who was responsible for Recommendation 923/1981 on the ill-treatment of horses during international transport, for the Parliamentary Assembly of the Council of Europe to the Committee of Ministers. He urged all of the contracting parties to "have as their long-term goal the complete abandonment of long-distance international transport of live horses for slaughter, and instead to export or import horse meat in [a] refrigerated condition" (paragraph 8(vi)) and to "invite the contracting states to the Convention to prohibit, until the goal mentioned in (vi) above can be achieved, road transport over distances longer than 500 km, obliging dealers instead to use transport by rail or sea" (paragraph 8(viii)).

In the concluding session of the Conference, Marie-Odile Wiederkehr, from the Directorate of Legal Affairs of the Council of Europe, summarized the activities of the Council of Europe in relation to animal protection.

Resolutions

The following three resolutions were carried:

(1) Bearing in mind the responsibility mandated by the Common Agricultural Policy statement to improve agricultural productivity by promoting technical progress, and recognizing public concern for the well-being of food animals, this Conference urges the European Commission to increase research into production systems that demonstrate due regard for the requirements of the Council of Europe Convention on the Protection of Animals Kept for Farming Purposes.

(2) Whereas it is desirable that animals should be slaughtered as near to the point of production as possible,

Whereas most stress arises during loading and unloading stock, particularly with regard to pigs, broilers, and spent hens,

Whereas not all countries are signatories to, or have ratified, the European

Convention for the Protection of Animals during International Transport,

Whereas undue delay in completing administrative procedures may lead to stress of animals in transit,

Whereas there is a need to ensure common standards for the design and construction of road and rail livestock transporters.

This Conference

(a) Calls upon member Governments of the EEC and of the Council of Europe to implement in full the provisions of the Convention on intercommunity transport of livestock and to do away with any bureaucratic hindrances.

(b) Believes that greater encouragement should be given to producers and transport operators to utilize loading facilities and techniques that are better adapted to the welfare needs of the animals concerned.

(c) Demands that there should be closer co-operation between governments, legislators, veterinary authorities, and transport operators in introducing improved facilities and procedures at points of embarkation.

(d) Calls upon the representative international road and rail transport organizations to agree upon common standards for construction of livestock transport vehicles with a view to improving the welfare of stock in transit.

(e) Considers that, in extreme emergencies, the primary aim should be to secure the welfare of the stock, and all possible steps should be taken to achieve this aim.

(3) The Conference

(a) Alarmed by the senseless suffering endured by horses for slaughter during international transport by sea, rail, and road from eastern to western Europe and in the Mediterranean region,

(b) Concerned that the European Convention for the Protection of Animals During International Transport, intended to remedy the situation, is not respected in certain contracting and non-contracting states,

(c) Commending Recommendation 923/1981 on the ill-treatment of horses during international transport adopted by the Parliamentary Assembly of the Council of Europe on October 1, 1981,

(d) Supports wholeheartedly the central request contained in the recommendation, namely, that the above-mentioned Convention be scrupulously respected; that non-contracting countries be encouraged to adhere to it; that the long-term goal should be that horses be slaughtered in the exporting country, rather than transported alive and, finally, that until this can be achieved, road transport of horses destined for slaughter over distances greater than 500 km should be prohibited.

How Effective Is the German Animal Welfare Act of 1972?

Introduction

A special group from the Academy for Continued Veterinary Education (Akademie für tierärztliche Fortbildung), concerned about the efficacy of current animal protective legislation, met on October 8-9, 1981 in Hanover (Federal Republic of Germany) to discuss the topic, Animal Welfare Practice: Problems and Experiences in the Implementation of the German Animal Welfare Act of July 24, 1972. The proceedings were subsequently published in the *German Veterinary Weekly* (*Deutsche Tierarztliche Wochenschrift*) on March 8, 1982 (*89*:115-132) and April 6, 1982 (*89*:159-172).

These papers were published because of a growing realization that the general public has become increasingly concerned about problems related to animal welfare legislation. Government officials, as well as the veterinary officers who are supposed to be responsible for the implementation of the law, have been criticized. There are, admittedly, many animal welfare problems for which veterinarians still owe an answer to the representatives of the animal welfare movement, as well as the public at large.

What Veterinarians Can Do

What stand should veterinarians take in regard to the ways farm animals

are reared and kept by agribusiness today? How do veterinarians feel about confining laying hens in battery cages? What are veterinarians doing to achieve some reduction in the numbers of animals (millions) that are used in experiments, beyond just expressing their good intentions?

An examination of the history of the 1972 Animal Welfare Act leaves no doubt that it was not the intent of the law to make any of the known rearing and housing systems of animals, including intensive methods, illegal, although complementary regulations exist, which work to correct some of the shortcomings of the Act. Opinions from scientific consultants can also be used to help veterinary officials interpret the law and thereby live up to the ethical responsibilities of their profession. Concerning animal experiments, vets must deal with the fact that many people are now demanding complete abolition of such experiments. The German Parliament, in response to public opinion, is presently debating the merits of a draft initiative whereby only those dogs and cats that have been raised and kept in special institutions could be used in experiments.

Other amendments to the law are also being discussed; for instance, some new regulation of the trade in companion animals may be justified, since the law does not seem sufficiently strong to counter the current level of abuses. The provisions of the law that relate to the transport and import of animals or animal products are also in need of improvement. These and similar observations were presented by A. Rojahn of the Federal Ministry for Food, Agriculture, and Forestry in Bonn.

K. Zeeb of the Institute for Animal Hygiene in Frankfurt spoke on the applied ethology of cattle. A knowledge of the specific needs of animals, he noted, would help upgrade the quality of their environments. This change would, in turn, lead to management systems that were sufficiently improved to do justice to the concepts of animal welfare. Such systems would also benefit the humans who must work in them.

The Trouble with Animal Transport

K. Geyer of Braunschweig discussed the road transport of animals, specifically the experience gained in the border control station of Helmstedt (between East and West Germany). Animals in shipment cross this point from the USSR, Poland, and the German Democratic Republic. Several problems for the veterinary officials that check on animal transport at the station were identified. Animals may originate from countries that are not bound by the European Convention for the Protection of Animals during International Transport; any attestations made do not contain information about the conditions of the animals at the point of origin of the journey; and animals found in poor condition cannot be returned to the USSR, Poland or the German Democratic Republic, since the German Democratic Republic will not accept them.

International transport of animals by rail was covered in a paper presented by J. Bornkessel of Bad Hersfeld. Veterinary authorities are primarily responsible for supervising animal rail traffic. In earlier years, rail was the preferred means of transportation, but in 1980 only 9,000 horses were carried by rail from Poland to France, as compared with the 27,000 horses that were shipped by road. A changeover from live to carcass transport of animals from Poland is presently not feasible, although carcass transport is preferable.

In his presentation, H. Langer of Freiburg took up the problem of how to ensure the humane housing of dogs in shelters; special regulations on sheltering dogs were enacted in 1974. An analysis of observations gleaned while supervising the keeping of zoo animals, companion animals, and small domestic animals, as well as an overview of the trade in these animals, was related by R. Rulffes of Hanover. In the Federal Republic of Germany, there are about 2,000 shops that deal in animals sold for these purposes. Veterinarians were reminded to give special attention to the transport and delivery of zoo animals.

E. Stephan, also of Hanover, introduced the subject of air traffic noise and an-

imal protection. He spoke of a correlation between level and type of noise and animal behavior and production indices, such as volume of milk. However, no effect has been observed between air traffic noise and eggs used for breeding purposes. Opinion is still divided about the consequence of aircraft noise on laying hens and broilers.

K. Gartner and J. Maess, of the Central Animal Laboratory and the Department for Experimental Animal Science in Hanover, reviewed the application and licensing procedures that obtain for animal experiments, and the supervision of the conduct of these experiments by government officials. He commented that a certain distrust of science has been read into the language of the German Animal Welfare Act by scientists; they believe that it threatens their "freedom of research." Scientists feel that they must retain primary responsibility for animal experiments, and that this responsibility should be recognized, just as it is in nuclear research, genetic engineering, and clinical research.

The Difficult Issue of Battery Cages

K. Voetz of the Federal Ministry for Food, Agriculture and Forestry in Bonn addressed the present legal problems concerning laying hens kept in battery cages. In this instance, the European Convention for the Protection of Animals Kept for Farming Purposes (March 10, 1976) applies. Of the 280 million laying hens in the 10 countries of the European Communities, 80 percent are now being confined in these cages. The lowest production costs and most profitable level of production are attained at a space allotment of 440 sq cm per hen, but those in the humane movement reject the whole idea of the battery cage system. In 1979, the Federal Republic of Germany had requested that the Council of the European Communities issue uniform rules on batteries: cages for light hens were to measure 600 sq cm per hen, while heavy hens were to be given at least 900 sq cm. Complete abolition of the battery cage system was to be accomplished by 1995. Research in alternative housing systems is still under way, but so far none of the proposed systems fulfills all of the humane requirements.

Other papers dealt with related topics such as the critical elements for ensuring proper ventilation of farm animal buildings and the cooperation of vets in issuing licenses for farming establishments.

The stunning of slaughter animals was discussed by G. von Mickwitz of the Freie Universität in Berlin. The speaker referred to the requirement stipulated by the Animal Welfare Act that stunning be performed prior to slaughter, but he also made note of provisions in the Directive of the European Communities, which was issued in November 1974. While the captive-bolt pistol and electrical stunning methods meet the essential humane requirements, the actual efficiency of stunning by these techniques in some slaughter houses remains in doubt. This difficulty is often caused by faulty application of the instrument or by a defective apparatus. Therefore, only an approved apparatus should be used, and there should be regular inspections to make sure that they work properly, as well as checks on the personnel who use them.

K. Drawer of Bochem presented a paper on the humane aspects of poultry slaughter. Poultry is specifically excluded from consideration in the Directive on Stunning issued by the European Communities. H.-J. Wormuth, Ingrid Schütte, and J. Fessel spoke on the same subject. They presented their recent experimental results and the practical significance of these results for the electrical stunning of poultry. Stunning of fish can be accomplished mechanically, chemically, or electrically as Dorothea Schulz of Berlin outlined, and slaughter can be performed by these same methods. Special attention was given to the preslaughter treatment of eels.

Obviously, this one meeting could not hope to cover all of the aspects of the implementation of the Animal Welfare Act, as the Act relates to animal protection. Therefore, the conferees decided to hold a second meeting on the same topic in the near future. —*Karl Frucht*

Tenth Vertebrate Pest Conference

While humane societies concern themselves with the problems of stray dogs and cats or laboratory animals or seals, the poisoning or killing of millions of animals with pesticides every year proceeds relatively unremarked. True, coyote killing is strongly protested, and animal welfare groups have opposed pigeon and bird pest control from time to time. Usually, however, the mere label of "pest" is sufficient to have an animal excluded from serious consideration by humane groups. If it is not only a pest, but also a rodent, then the animal is almost certain to have no human defenders. Nevertheless, the tenth annual Vertebrate Pest Conference at Monterey, CA (February 23-25, 1982) provided much of interest for the new wave of animal welfare advocates, and suggested that it is perhaps time to take another look at some of the ways pests (and not just coyotes or pigeons) are killed every year.

The organizers and speakers at the tenth Vertebrate Pest Conference were clearly well aware of the potential interest in this subject from animal welfare groups. The chairman of one session urged the members of the audience to join the National Animal Damage Control Association (NADCA) to help counter false statements made by environmentalists. William D. Fitzwater, president of the NADCA and a speaker in the same session, discussed the use of rodent glue boards. Glue board popularity has increased in the last 20 years, but it was recommended that the traps be covered so as to hide the struggles of animals stuck in the glue from public view. He argued that the animal usually dies quite quickly because its nose becomes caught in the glue, and it then suffocates. When he was questioned on some of the humane aspects of this method of control, he joked that he had been told to stay away from such issues. This type of comment was fairly standard for the conference, where an attitude of "them" (environmentalists and animal welfare folk) vs. "us" prevailed.

The conference opened with a keynote address by Dr. Donald Spencer, a consultant ecologist with the National Agricultural Chemicals Association. He commented on the fact that 90 percent of the nation's population resides in urban centers; these people are remote from the process of food production and consequently are more interested in animals as they relate to environmental preservation and recreation. Because most of the population has little awareness of the problems suffered by a rural community, they can be easily influenced. This factor, he said, is one of the elements in the present controversy over animal damage control.

According to his classification, there have been three main eras in vertebrate pest control. Between 1900 and 1930, strychnine was widely used but was not particularly satisfactory because it acts quickly and the slow acceptance of toxic bait by the targeted animals can result in "tolerance." Between 1930 and 1955, thallium, Compound 1080, and zinc phosphide were introduced. Control was far more effective during this period. The present era, in his view, is one of "wheel-spinning," because some of the more effective control measures (notably 1080) have been discontinued, and no reliable alternatives have been introduced.

There has been relatively little interest in the development of new tools for animal damage control. The high cost of registering a new chemical and the relatively small market for such a chemical are two factors that contribute to this state of affairs. The unpopularity of various forms of pest control (*e.g.*, for birds and coyotes) has also caused the larger companies to avoid this market, for fear of an adverse effect on the rest of their product line as a result of the bad publicity that might accrue from marketing a few pest control products. According to the speaker, the current efforts aimed at revocation of the executive order banning 1080, as well as debate over the Endangered Species Act, are significant signs for an improved market situation in the future.

The first session at the Conference covered rodent control. Dr. Ronald Ericson of Gametrics Ltd (Sausalito, CA) discussed the use of alphachlorohydrin as a potential new sterilant. This chemical is both toxic and a sterilant; use of it has demonstrated acceptable population decreases (with no rebound) that persist for at least 6 months. Another potential new rodenticide is bromethalin, which apparently has been developed as a response to the problem of anti-coagulation resistance. It is unusual in that it is a single-feeding rodenticide (unlike the anti-coagulants, which must accumulate over a period of time in the body), but bait timing and placement are crucial. Dr. William Jackson of Bowling Green University (Ohio) contended that secondary poisoning will not be a major problem, because only small quantities of bait need to consumed.

The use of glue boards and bird limes was discussed by William Fitzwater of BioLOGIC Consultants (Albuquerque, NM). He noted that glue board popularity has increased considerably in the last 20 years because of negative public attitudes toward pesticides. There are several advantages to this method: the glue board is not toxic, there is no odor problem when the animals die in out-of-the-way places, and there are few restrictions on its use. Disadvantages include the fact that the effectiveness of the boards is affected by temperature changes, and that dust and grease can be problems. They are also more expensive than snap-traps, because they are normally discarded after one use. This speaker, too, argued that the trapped animal suffocates rapidly because it gets its nose stuck in the glue, but this claim has been disputed by humane groups.

The second major session covered the more controversial topic of predator control. Robert Horwell (Deputy Agriculture Commissioner, Los Angeles County) began the session on a high note when he commented that the coyote in Los Angeles is a "spoiled" animal, as a result of the plentiful food that is available from uncovered garbage cans and plastic garbage bags. He also noted that the coyote has become oblivious to human scent in urban areas and may well attack pets and even children. A member of the audience suggested that the problem could be effectively addressed by requiring changes in the system of garbage disposal and collection, but Howell responded that no changes (via ordinances and the like) are anticipated.

The session then moved on to the problem of coyote control in rural areas where the non-availability of suitable poisons has led to a search for other methods of control, such as fencing. This topic was addressed by Dr. Dale Wade of the Texas Agricultural Extension Service.

However, the members of the meeting rapidly focused their attention once more on the issue of poisons during an address by Dr. Ernest Kun (University of California, San Francisco), who has been studying the toxicity of 1080 and its mechanism of action. While Kun presented a new theory on the proposed mechanism of action of 1080 which would indicate that secondary poisoning could possibly be less of a problem than previously thought, the most interesting aspect of his talk came to light outside the conference: It seems that a copy of a letter from the University of California, signed by the Assistant Chancellor for Legal Coordination and sent to Ann Gorsuch, Administrator of Environmental Protection Agency, accused the EPA of falsely using Kun's work to support EPA's claim that the 1080 ban should be lifted.

The session then moved on to a favorite theme of the humane movement—the suggestion that guard dogs be used to protect sheep from coyote predation. William Pfeifer of the Fish and Wildlife Service (North Dakota), presented data from interviews with 36 ranchers in North Dakota who use dogs. (They were also using other animal control measures concurrently.) Most of the dogs were of the Great Pyrenees breed, and they apparently reduced the overall sheep loss from predation from 6 percent to 0.4 percent. Twelve of the ranches had no further losses, and another 12 ranches reduced their losses from approximately 30 sheep per year to 2 sheep per year. Ty-

pically, one Great Pyrenees dog guarded approximately 590 sheep in a 250-acre pasture. More dogs had to be used for bigger flocks and pastures. Apparently, the mere presence of the dog acts as a deterrent to predators. When the dog was removed for some reason, even for a few days, predation resumed.

The conference moved on to the issue of control of field rodents, and ground squirrels in particular. Traditionnally, ground squirrels inhabit dry grasslands, where they compete with cattle for forage. Ground squirrels eat crops and livestock feed, and their burrows cause damage to field equipment. Generally speaking, ground squirrel populations are controlled by using acute poisons such as strychnine or zinc phosphide, and then the population is kept low with anti-coagulants, which are more expensive and take longer to work. One comment was that shooting is ineffective, but does satisfy psychological needs.

There seemed to be little concern about carcasses lying around or the question of secondary poisoning. It was reported that the California Department of Fish and Game had recently received five eagles that had been poisoned by consuming strychnine-killed rodents. It was noted that two of the eagles still had strychnine-contaminated squirrel remains in their intestinal tracts. Nevertheless, it was recognized that, while this did not prove that the strychnine had, in fact, killed the eagles, it was getting "pretty close" to real evidence.

Dr. Dale Kaukeinen (ICI Americas, NC) addressed the question of secondary poisoning, which was reported in a paper on the effect of "Talon" on barn owls. Approximately 10 owls visited the treated sites regularly, for a period of up to 2 months: no mortality was observed. All owls, however, showed residues of the chemical in all tissue samples that were analyzed. The speaker also commented that predators are of relatively little value in controlling the rodent pest population.

One of the main problems in considering all animal damage control programs is the question of how to determine which aspects of the damage have been caused by the animal pest. Dr. Patrick Weatherhead (Carleton University, Ottawa) studied samples of the damage to corn crops attributed to blackbirds in Quebec and produced estimates that were 60 times lower than the figures produced by the government. Weatherhead's estimates were, however, comparable to similar damage estimates in Ohio and Ontario. When asked about the discrepancy between his figures and the government figures, he responded that the government based its estimates on interviews and meetings with farmers, rather than on actual sampling of the damage.

Public relations was also mentioned as an important consideration, especially for pigeon control. Colleen Martin of Bluebird Enterprises in California noted that one must first determine the publicly acceptable morality, and then decide on which method of control to use. Netting was described as the most effective control technique for a large-scale problem, but a variety of deterrent devices can be used to reduce the pigeon population in inaccessible places.

In conclusion, the general tenor of the conference did not raise hopes that humane concerns about pest animals will be given more serious consideration, at least not in the near future. Instead, most participants seemed to consider animal welfare complaints as an unfortunate side-effect of urbanization and a simple consequence of consumer ignorance. There was widespread hope among the conferees that 1080 would once again become available to control coyotes. However, Kun's allegations of EPA misrepresentation of his data did not help their cause.

Anybody wishing to obtain a copy of the proceedings of the conference should send $10 (checks payable to Vertebrate Pest Conference) to Dell O. Clark, Exclusion and Detection, Department of Food and Agriculture, 1220 N. Street, Sacramento, CA 95814. — *Natasha Atkins*

FORTHCOMING MEETINGS

The American Forestry Association: 2nd Annual National Urban Forestry Conference, October 10-14, 1982, Cincinnati Convention Center and Stouffer's Towers Hotel, Cincinnati, OH. Of interest to those concerned about the interaction between animals and the environment will be sessions on urban forestry; recreation and wildlife: the multiple uses of community forestry; environmental education in interpretation; and integrated pest control. Contact Henry De Bruin, American Forestry Association, 1319 18th Street, NW, Washington, DC 20036.

American Society for Testing and Materials: Symposium on Pesticide Formulation and Application Systems, October 12-14, 1982, Drawbridge Motor Inn, Fort Mitchell, KY. Contact Don Viall, (202) 299-5546.

Shipping World & Shipbuilder and Aniservices International: "Anitrans '82," October 21-22, 1982, London. Various aspects of animal transport will be covered, including the extent of the trade, financial implications, international laws and regulations, transport of animals to and from the ship, experiences of an animal carrier, insurance, the World Wildlife Federation's point of view, the animals' welfare, case studies, ship design and operation, animal condition monitoring, and loading/unloading and port practice. Contact G.B. Taylor, 6 Rosedale Close, North Hykeham, Lincoln, U.K.

Alternatives in Toxicology: An international meeting which will include extensive discussion of the above topic will be held at the Royal Society in London, November 1-3, 1982. It is suggested that those who are interested contact FRAME, 56 The Poultry, Bank Place, St. Peter's Gate, Nottingham, NG1 2JR, U.K.

Centaur Productions, Inc.: Equestrian World Expo 1982, November 3-6, 1982, New York, NY. The exposition will feature the presentation and demonstration of equestrian-related products and services, as well as educational seminars on pertinent subjects. Contact Mason Phelps, Centaur Productions Inc., P.O. Box 330, Newport, RI 02840.

International Institute for the Legal Protection of Animals: Inauguration of the International Legal Defense of Animals, November 26-28, 1982, Bordeaux, France. This conference represents the first attempt to establish international collaboration on methods for promoting the legal defense of animals. Items to be covered will include: the legal position of animals; general texts of legal defenses of animals in different legal codes; legal and regulatory studies of certain specific problems such as intensive breeding, animal fights, and vivisection. Contact International Institute for the Legal Protection of Animals, 86 rue du Pas St.-Georges, 33000 Bordeaux, France.

ASTM Committee E-47 on Biological Effects and Environmental Fate: 7th Symposium of Aquatic Toxicology, April 17-19, 1983, Milwaukee, WI. Papers are now being solicited for this meeting in the following subject areas: new methods and concepts for testing and assessing the aquatic hazard of materials (e.g., chemicals, efflents); sublethal effects; bioavailability and recent advances in environmental chemistry; biological and ecological implications of responses of organisms to materials; and lab vs. field—how good is our predictive capability and what confounds extrapolation and assessment *in situ*. Contact Program Chairman, Dr. Rick D. Cardwell, Envirosphere Company, 400 112th Avenue N.E., Bellevue, WA 98004.

Association of Institutes for Tropical Veterinary Medicine: International Conference on Impact of Diseases on Livestock Production, May 9-13, 1983, Kissimmee, FL. Contact Dr. M.J. Burridge, Director, Center for Tropical Animal Health, College of Veterinary Medicine, Box J-136, University of Florida, Gaines-

ville, FL 32610.

Latham Foundation, AVMA, and CVMA: Conference on the People/Animal Bond, June 17-18, 1983, Irvine, CA. Interdisciplinary perspectives on people-animal relationships and environments will comprise the focus of this event. Contact William J. Winchester, DVM, Department of Animal Resources, University of California, Irvine, CA 92717.

Latham Foundation, AVMA, and CVMA: Conference on the People/Animal Bond, University of Minnesota, June 21-22, 1983, St. Paul, MN. This meeting will also provide a forum for an interdisciplinary discussion of "the bond"; many of the disciplines represented have not previously addressed the topic of human/animal bonding. Contact William J. Winchester, DVM, Department of Animal Resources, University of California, Irvine, CA 92717.

International Council for Laboratory Animal Science: "The Contribution of Laboratory Animals to the Welfare of Man and Animals: Past, Present, and Future," July 31-August 5, 1983, Vancouver, BC, Canada. Topics covered will include: a geographic overview of laboratory animal science; the animal model in gerontological studies; the development, status, and future of international quality in laboratory animals (standardization); and new and future trends in biotechnology. Contact Mr. D. Jol, ICLAS/ CALAS 1983, Box 286, 810 West Broadway, Vancouver, BC, Canada V5Z 1J8.

Australian Society for the Study of Animal Behavior and the Australian Academy of Sciences: 18th International Ethological Conference, August 29-September 6, 1983, Brisbane, Australia. Potential participants are being given early notification for this conference, since this is the first time an International Ethological Conference has been open to all behavioral scientists, and therefore no channels of communication have been established to reach all those who might be interested in attending. The content of the plenary sessions has not yet been determined, and the committee sponsoring the conference would welcome any suggestions on possible session topics. Plenary sessions will be strongly didactic, but will also provide a general overview of recent developments and highlight any problems or controversies. Contact Conference Secretary, Animal Behavior Unit, University of Queensland, St. Lucia, Australia 4067.

IEMT: International Symposium on Pets and Society on the 80th Birthday of Professor Konrad Lorenz, October 17-19, 1983, Vienna, Austria. Contract Secretary, IEMT, Johann-Blobner Gasse 2, A 1120, Vienna, Austria.

ANNOUNCEMENTS

Cull Dairy Cows— Humane Treatment by Local Collectives

In some areas of Britain, the National Farmers' Union has drawn up schemes for the humane disposal of cull dairy cows which offer both economic and welfare advantages. Essential to the plans is the formation of area collectives, which make arrangements for slaughter of all cull animals with a local abbatoir. The abbatoir selected must be approved by the EEC, since meat prices depend on the export market. The farmer pays for transport of the cows, but transport itself is scheduled by the collective; all cows are slaughtered with 24 hours of collection. To date, 10 of these collectives have become operative. Further information can be obtained from the NFU Marketing Division, National Agricultural Centre, Stoneleigh, Kenilworth, Warwick, U.K.

The Problem of Feral Cats

Increasingly, groups of wild cats have begun to colonize urban sites such

as apartment buildings, factories, hospitals, parks, and gardens. The RSPCA has issued a report, based on a 4-year study of 287 feral-cat colonies, on the behavior of these feral cats — how to assess whether the colonies will create real problems and suggested methods for controlling populations of the animals. Copies can be obtained from the RSPCA, Causeway, Horsham, Sussex RH12 1HG, U.K.

New Bibliographies: Endangered Species and Wildlife Resources

A 228-page comprehensive bibliography on all of the published literature on the concepts, principles, and extent programs related to endangered species has been published and is now available from the Florida Game and Fresh Water Fish Commission, 620 S. Meridian, Tallahassee, FL 32304.

Robert L. Ruff has compiled a second guide to the literature entitled *A Bibliography of Cooperative Extension Service Literature on Wildlife, Fish, and Forest Resources.* This reference work is available from the Department of Wildlife Ecology, Cooperative Extension Programs, University of Wisconsin, Madison, WI 53706.

New Research Center for Behavioral Physiology of Farm Animals

The Agricultural Research Council's Institute of Animal Physiology at Babraham, U.K., has begun construction on two new laboratories. The first will focus on that most trendy of research topics, monoclonal antibodies. But the second facility will be devoted solely to investigations into the physiology of farm animals, specifically, their bodily and behavioral requirements. Bob Baldwin, from the applied biology department, has commented that we know more about the behavior of lab rats than farm animals; work already done at the Institute has included evaluations of taste preferences and motivational drives. For example, one finding has been that, given their own choice, calves prefer light to darkness for 60 to 70 percent of the time. Also, studies on pigs have shown that they form definite social structures, in which animals sort themselves out into dominant or subordinate roles. The data gained at the new lab will be used to develop more humane systems for husbandry and housing.

International Group Formed to Promote Animals' Legal Rights

An International Judicial Institute for the Protection of Animals has recently been formed in Bordeaux, France. The group defines itself as "distinctly separate from the traditional associations for the protection of animals in that, for the first time, jurists (lawyers, judges, university teachers, etc.) are taking into their own hands the delicate problem of the judicial defense of animals." The groups will work to effect change in the various nations' codes in which animals are now classed merely as chattel. So far, the group has succeeded in persuading the Ministries of Justice, Agriculture, and the Environment to cooperate with them in the formation of a Commission to draft legal reforms for the direct protection of animals, and for the more complex goal of upgrading the judicial status of animals. The group will soon be holding a conference (see Forthcoming Meetings) to discuss possibilities for international action on the legal status of animals.

An Animal Rights Group for Students

Rosa Feldman, Marshall Weisfeld, and John Shirkey of Washington, DC, have founded a new national organization, the Student Action Corps for Animals. Its purpose is to create a nationwide network of students who can work together within defined geographical areas on

local problems, but also link up with a larger group of other students on issues that require national collaboration for appropriate action. Its vehicle for exchange of information and updates on resources is a 6-page newsletter, *SACA NEWS;* volume 1, number 1 has already been published. For more information, contact SACA, 423 5th Street S.E., Washington, DC 20003.

Psychologists for the Ethical Treatment of Animals

Some concerned individuals within the APA have formed PsyETA (Psychologists for the Ethical Treatment of Animals, Dr. Kenneth Shapiro, Bates College, Lewiston, ME 04240). They have begun to petition for the establishment of a special group within APA dedicated to the protection of animal subjects in experimentation. They also hope to stimulate research into areas relevant to human-animal interactions.

Wild Horses and Burros— Management and Legislation

Representatives from a number of organizations interested in protecting wild equine populations convened at the Humane Society of the U.S. in Washington, DC, on June 18, 1982. The principal objective of the meeting was to formulate a common set of goals and strategies for the careful, long-term management of wild horses and burros, to counter the recent aggressive campaigning by other interest groups and government officials to employ more drastic means to limit the herd size of these animals. These latter groups have advocated slaughter and massive adopting of horses, because they believe that horses cause extensive damage to range vegetation, on range land that they feel ought to be preserved for sheep and cattle.

The hopes of all of those who have a stake in the fate of wild equines had been pinned on the successful completion of a series of government-funded studies to be suggested and then completed by the National Academy of Sciences. But, as F.H. Wagner, the Chairman of the NAS Committee on wild horses noted, the change of administration brought severe budget cuts to research on wild equines. During the Carter administration, NAS did manage to get sufficient funds to complete Phase I of their work. Phase I comprised an analysis of the inadequacies of the old system for managing wild horses and burros, and development of a new program of 18 recommended studies. The studies were designed to gain basic data on topics such as the patterns of competition for forage between cattle and sheep; wild-horse nutrition; an evaluation of census procedures; and fertility factor analysis of horse and burro breeding patterns.

Of the 18 projects originally suggested, only 6 received funding for actual implementation in Phase II. For example, a study on census techniques showed that fixed-wing aircraft only provide adequate data on open terrain; in any other environment, helicopter counts are far more reliable. Dr. Wagner acknowledged that he still held out some hope for further funding, but noted that the report on Phase II was due in Congress by January 1, 1983, so that it was unlikely that much more work could be accomplished before the drafting of the report would have to begin.

W. McCort, of the University of Wyoming, has completed most of his work on one NAS project, "Wild Horse Habitat Preference and Use and Vegetative Responses to Grazing," and gave a brief presentation on what he had found out. He did his research on a 540-sq mile tract in southwest Wyoming, that now carries about 800 to 1,000 horses, as well as cattle, sheep, elk, deer, and pronghorns. The specific variables considered were topography used by each species, water needs, and types and quantities of vegetation consumed. Within this study area, 100 1-sq km plots were marked off. These were visited about once a month, and data on the selected variables were collected.

It was found that habitat (especially type of vegetation) could explain

about 50 percent of animal distribution, and that there was considerable overlap between the distribution of horses and cattle. However, horses can travel farther from water sources than cattle, and are able to use snow as a water source, when it is available.

The horses in the study area are part of a larger herd of approximately 6,000; the Bureau of Land Management want to reduce this herd to 1,500 horses. Dr. McCort stated that this reduction represented a reasonable objective, since his studies had shown that the vegetation near some waterholes has been nearly eradicated because of overgrazing by horses.

However, Dr. Michael Fox of the HSUS countered by noting that, in fact, cattle using the waterholes are a more probable culprit for destruction of vegetation: they may simply be trampling down all the plants in the area. He also observed that wild horses help keep cattle healthy by destroying bovine endoparasites in their rumen.

Dr. J. Kirkpatrick spoke on his experiments with the reversible chemosterilant testosterone propionate, which can be used to decrease sperm motility (and therefore fertility) of stallions. He discovered that this agent does work effectively to induce an infertility that is naturally reversible in 3 to 4 months. One problem with the use of chemosterilants in domestic horses is the fact that mares have a long breeding season — many are still fertile in December. But wild mares have a shorter breeding season: ovulation is rarely seen after the beginning of Fall.

Hope Ryden, who spoke next, believes that the whole concept of sterilizing stallions, even temporarily, is ill conceived, since the procedure severely disrupts the age structure of the herds. Similarly, among sperm whales, whole generations are missing, and total population decrements will occur even if they are no longer hunted, until the time comes when sufficient numbers of young whales have achieved sexual maturity. Thus, she advised, it is better to use females for any proposed population control measures.

To Ryden, horses and burros that have co-existed with other species for so many years can hardly be considered "exotic" animals. They have co-evolved with other indigenous species, and there is no evidence that they are overly competitive.

Current BLM census data on horses and burros is of dubious value, in Ryden's view, partly because age and sex structure of herds are not considered — only total numbers. Also, BLM reproduction rates recently cited are higher than the biological limits of the animals. She recommended that the best way to keep herd sizes at predetermined levels is to remove young female animals, and to cull these from herds as they are requested by potential adopters. One possible benefit of this policy would be that, because stallion numbers would remain high, only the fittest horses would successfully reproduce; therefore, the best genes would be preserved from generation to generation.

After a discussion on the McClure Bill to amend the Wild Horse and Burro Act of 1971, and some general debate, the conferees agreed to support three recommendations:

1. Wild horses and burros should be managed as humanely and unintrusively as possible. Biological methods for population control such as habitat and forage manipulation, use of chemosterilants, and alterations in sex ratios, are preferable to more invasive techniques like roundup and sale.

2. The Wild Horse and Burro Act should *not* be amended to legalize outright sale (and eventual slaughter) of horses.

3. The NAS-recommended studies should be fully funded, and completed before any legislative changes are enacted.

Book News

Eye Irritation Testing, K.J. Falahee, C.S. Rose, S.S. Olin, H.E. Seifreid (Tracor Jitco, 1776 East Jefferson Street, Rockville, MD 20852; 1981). An exhaustive review of the Draize rabbit eye test is presented

in this volume, and some of the future possibilities for other tests of potential irritancy of chemicals are described. It is an essential book for all those who are interested in a detailed discussion of the test. For obvious reasons, the review has not included any reports of recent research efforts that seek an alternative method of providing the same kind of information, although it does contain a useful discussion on the effects of local anesthetics. Single copies may be obtained free of charge from Tracor Jitco.

Mammal Species of the World: A Taxonomic and Geographic Reference, J.H. Honacki, K.E. Kinman and J.W. Koeppl, eds. (published jointly by Allen Press, Inc., and the Association of Systematics Collections, Lawrence, KS). Compiled for use by the parties to the Convention on International Trade in Endangered Species as a standard reference to mammalian nomenclature, this 1-volume work provides a systematic guide, or checklist, to the taxonomy of all known species of mammals. Four types of information are provided on the 4,170 mammalian species included in the checklist: (1) author of the scientific name of the species, with appropriate citation; (2) type locality (the geographic location at which the type material of each species was collected); (3) a short verbal description of distribution; and (4) citations of revisions or reviews, important synonyms and, when necessary, explanatory comments. Species that are currently protected by the U.S. Endangered Species Act are indicated by annotations in the text, and ISIS (International Species Inventory System) numbers are given for all species.

In the Preface, the editors make note of their realization that this guide, essentially a printout of a computerized data base, can only represent the "state of the art of mammalian taxonomy"; therefore, frequent updated revisions of the book will be a requisite part of their efforts.

Badgers Without Bias, Robert W. Howard (Abson Books, in association with the Arun Wildlife Trust, £1.50). In Britain, the badger, *Meles meles,* ranks as one of the most popular of our wild animals, so it is hardly surprising that, when the Ministry of Agriculture, Fisheries and Food announced its policy, in 1975, for gassing badgers (in an attempt to control bovine tuberculosis), there was a public outcry.

Robert Howard sets out to take an objective look at the controversy about tuberculosis in badgers and cattle. He is well equipped for the task, since he is a veterinary surgeon who works in one of the affected counties, and the badger is clearly an animal that excites his interest.

Badgers Without Bias is something that we have needed for a long time — an excellent, unbiased summary of a very complicated subject. The first half of the booklet contains a general summary of the nature of the disease, its occurrence in badgers and other animals, and the biology of badgers. Having set the scene, the author devotes the remainder of the book to a discussion of the policy of the Ministry to badgers and to TB, and the public's reaction to its policy.

As Howard states in the preface;

> *Objectivity is the aim. No attempt is made to persuade, or foster the opinion of those holding any particular point of view. I start with an acceptance that tuberculosis does exist in badgers in some parts of south-west England, but whether or not the measures which are being taken on account of that situation are jusfified is a matter left to the judgment of readers. My aim is to present the facts and the arguments so that a reasoned conclusion can be reached.*

To achieve this balance, Howard poses three questions: (1) Is it a proven fact that badgers constitute a significant reservoir of infection from which cattle contract tuberculosis? (2) If so, is it necessary and right that we should attempt to control the disease in the badger? (3) If the answer to both of these is yes, is the Ministry going about such control in the right way? On each of these questions, Howard advances the arguments for, and against, particular points of view.

So much has been written on this controversial issue that it is inevitable that some of the assumptions and arguments in *Badgers Without Bias* lack sufficient backup material, but for those interested in the issue, this book does provide a sound basis upon which to form a reasoned conclusion.

Badgers Without Bias is an inexpensive account of a complex environmental problem. Copies can be obtained from Abson Books, Abson, Wick, Bristol, BS15 5PT.

S.A. Ormrod,
Chief Wildlife Officer
RSPCA, U.K.

Scientific Aspects of the Welfare of Food Animals, Report No. 91 (Council for Agricultural Science and Technology, 250 Memorial Union, Ames, IA 50011). This report presents a thorough survey of the various aspects of the welfare of farm animals, at least as far as the English-language literature in this field is concerned. Not only are individual species such as hens, pigs and ruminants discussed, but topics related to handling, management pratices, and transport and slaughter are covered in detail as well, and investigated in regard to their relevance to animal protection. In scanning the chapter headings, though, the connection between the headings and animal protection does not becomes immediately clear (one example: the heading "Milk Production"), and one might wonder whether questions of economics have been given top priority by the author. However, the actual contents of the chapters certainly demonstrated that the important questions that are germane to animal welfare have also been considered.

The report ends with the following sentence (with similar allusions scattered throughout the report): "Many additional psychological and ethological studies are needed to improve our understanding of animal welfare and to make possible further improvements in animal agriculture and animal welfare." While it is surely always advisable to advocate accumulating more data and more knowledge, it must be emphasized that not all of the relevant publications have been consulted in the compilation of this volume. In the main, only the English-language literature has been cited. Other references, especially those in Scandinavian and German, have been almost totally neglected. This fact would not be of any major consequence if it did not influence the final product. However, European studies on animal welfare are important and, with more references to the international literature, some aspects of each topic covered would have been put in a broader perspective.

It is incomprehensible how the report could state that there are "natural tendencies for feather-picking, fighting and cannibalism." For underlying these kinds of behavioral disorders (with the exception of fighting) lie the boredom and frustration that result from stimulating surroundings and improper handling. Therefore, we can say that these disorders are certainly not natural; they are man-made. Altogether, far too little attention is being paid at present to the behavioral needs of the animals. Neglect of these needs can constitute an animal welfare problem in itself; morphological or physiological changes need not become evident. It is correct to state that birds in the wild experience up to 85 percent mortality and that early strains of domestic birds experienced mortalities of up to 50 percent. However, these facts have little bearing on today's problems and should not give us occasion for simplistic excuses. We should start by utilizing our present level of knowledge about domestic animals and use this to consider the possible ways of protecting them. Only in this manner can we say that we are acting in a responsible manner. To act responsibly within the pure context of animal welfare issues also means that economic aspects have to be temporarily set aside.

Nevertheless, this publication is still worth reading and digesting.

H.H. Sambraus
University of Munich
Federal Republic of Germany

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Manuscript organization: Title page (pg. 1) containing title of the article (maximum of 48 characters), author(s), affiliation, present address, address where proofs should be sent; Abstract (pg. 2); Text (begin pg. 3), which includes introduction, methods/procedures, results, discussion, conclusion, acknowledgments, references, tables, and figure legends. Special instructions for the copy editor or printer should be affixed on the original copy.

Abbreviations and units: Standard dictionary abbreviations are generally accepted. Other abbreviations should be explained when first mentioned. SI units are preferred.

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Sample references

Smith, J. (1970) The effect of stress in swine on meat quality. *J Appl Ethol 5*:125-127.

Smith, J. and Jones, S. (1970) *Animals*, 2nd ed., Academic Press, New York, NY, pp. 8-14.

Tables: These should be concise and typed double-spaced throughout.

Figures: Submit 3 sets of glossy prints (no negatives) with identifying arrows and letters contrasting sharply with the background. Indicate on the back the author's name, figure number and "top."

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News and Comment Articles: 1000-2000 words and where necessary, brief references cited, e.g. (*Appl Ethol 10*:111, 1979) in the text.

Review Articles: 5000-8000 words with a comprehensive list of references to be used as source material.

Original Articles: Up to 5000 words or long enough to provide an adequate introduction (stating the objective of the study and why it is considered necessary), description of methods (including an outline on the treatment of the research animals and the number of animals used), and combined results/discussion section. Articles that deal with research involving animals must acknowledge the ethical dimensions of the work; concerning specifics, potential authors may want to consult the editorial office.

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